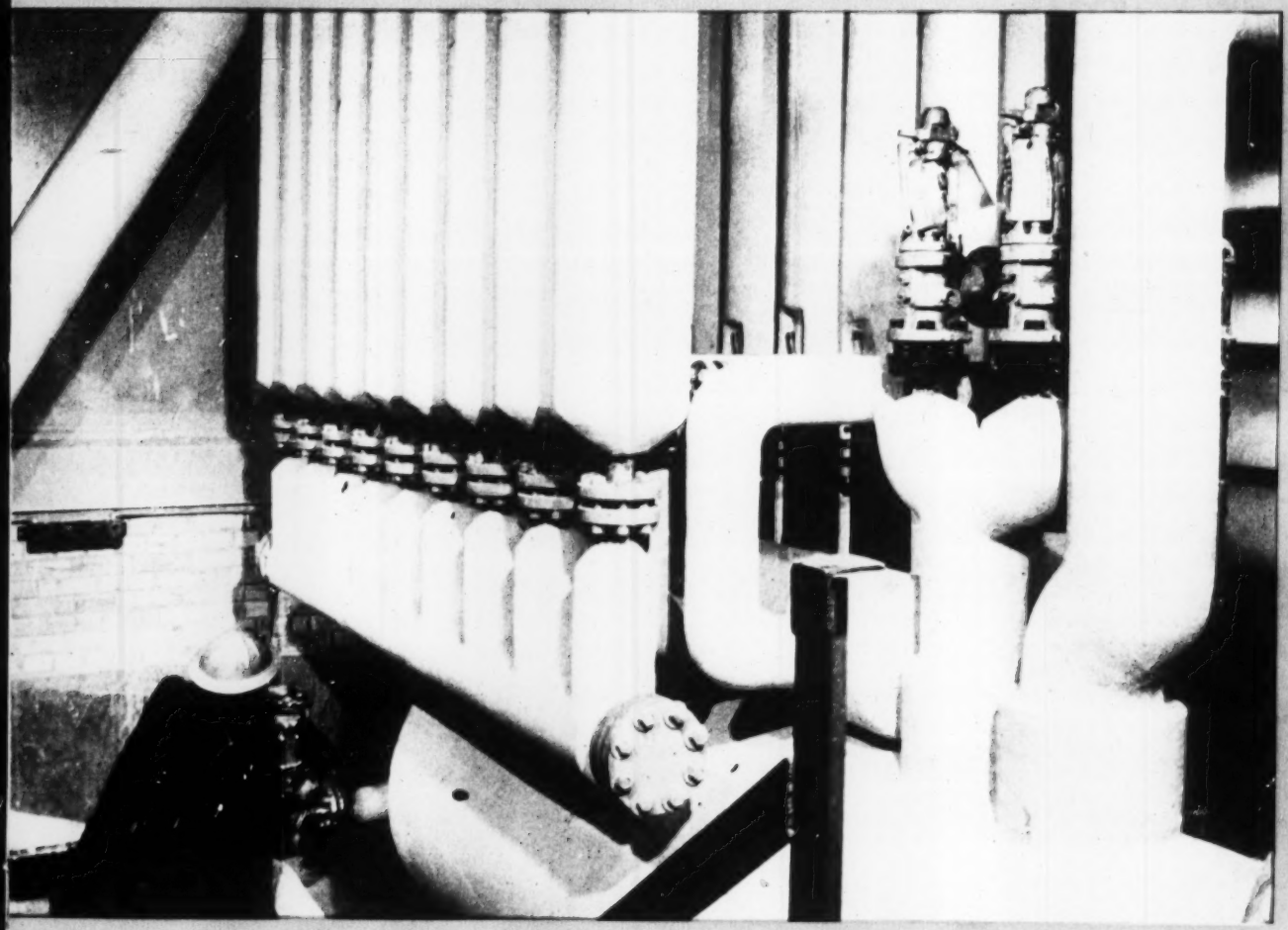
Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

JULY ★ 1953

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Page 125—Journal Section of The American Society of Heating and Ventilating Engineers



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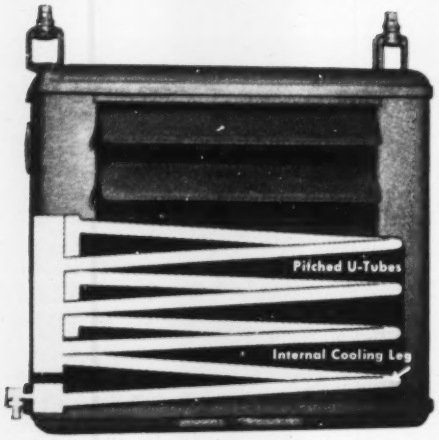

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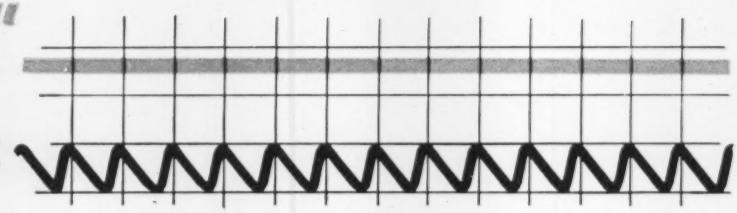

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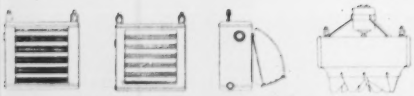

THERMOLIER FEATURES

INTERNAL COOLING LEG A Grinnell feature which permits the use of a plain thermostatic trap for draining condensate.

PITCHED U-TUBES Built-in pitch of U-tubes provides complete drainage of condensate and elimination of destructive water hammer.

CONTINUOUS RATED CAPACITY The combination of Thermolier's internal cooling leg and the built-in pitch of tubes assures continuous rated capacity.

BUILT-IN EXPANSION PROVISIONS Every tube is an expansion bend of the U type to allow for independent expansion and contraction of each tube.

TUBE-TO-HEADER CONSTRUCTION Safety and durability assured by unique tube-to-header construction.

EASE OF ERECTION Exclusive with Thermolier are the adjustable swivel couplings which provide an easy, cost-saving method of hanging the unit.

SIMPLE PIPE CONNECTIONS The supply and return piping connections are on the same side to assure compactness, neatness and economy in installation.

MOTORS Thermolier motors are built specifically for unit heater duty. They give maximum operating efficiency with minimum power cost.

The practical advantages of unit heating, of course, are well known. But in order to get *maximum* economy and efficiency, certain engineering and structural features *must be* present in the unit heater of your choice.

Take provisions for draining off condensate. Failure to provide freedom from collected condensate in the heating element can interfere with heat output and adversely affect capacity.

A Thermolier Unit Heater successfully handles this drainage problem with its pitched U-tubes and internal cooling leg, through which all the condensate passes. In fact, condensate cooling is so efficient with Grinnell Thermoliers that a thermostatic trap — the simplest and least expensive of all traps — can be used with every model. Condensate temperature is lowered to the point where the trap is always draining — giving Thermolier Unit Heaters their *continuous rated capacity*.

Check Thermolier's advantages at left. For more details, call your local Grinnell distributor — or send for catalog.

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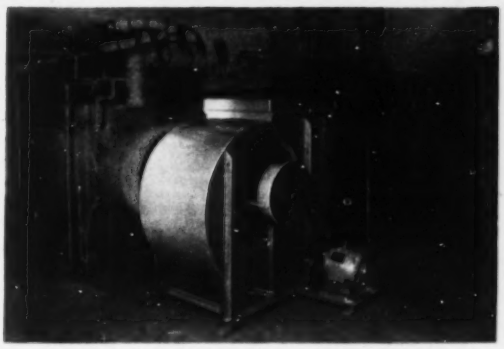
To meet budget limitations, a zone system, with four or five rooms to each zone, was adopted. The central plant in each school consists of two United States Air Conditioning Corporation blowers, moving air over steam coils. One fan (handling 20,000 CFM) supplies the main classroom section of the building. The second fan (a 10,000 CFM unit) supplies the office-playroom-cafeteria wing. Blowers are forwardly curved, single inlet—single width, with counter clockwise rotation and top vertical discharge.

The main supply ducts are located in tunnels under the hallways, leading to branch ducts



of concrete, buried under the masonry floor, carrying supply air to the individual rooms.

In each classroom, four vertically discharging grilles, spaced along the outside wall, blanket the glass surface with hot or tempered air. Return air is drawn out through the corridors to a large return air grille in the main hallway. An automatic damper in the return duct goes into operation after the building is up to temperature, introducing fresh air into the system.

All buildings were designed by Knappe & Johnson, architects, with Albert Fentzlaff as consulting engineer and the Willner Heating Company as the heating contractor.

for descriptive literature on Blowers write Dept. HP 753

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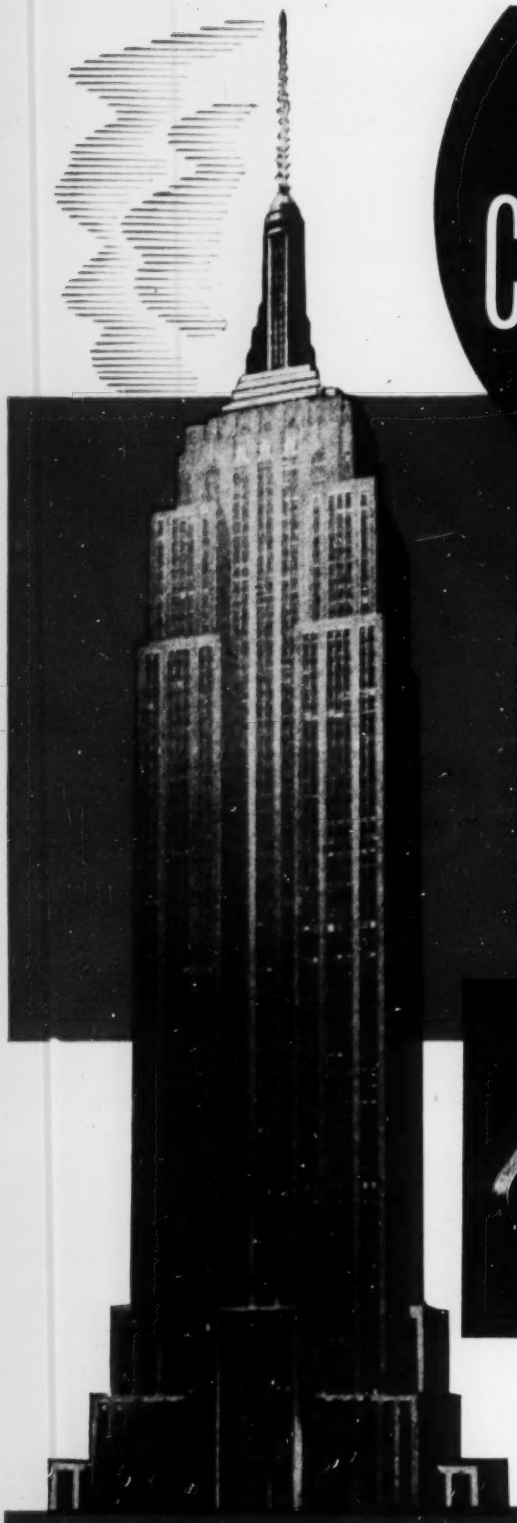

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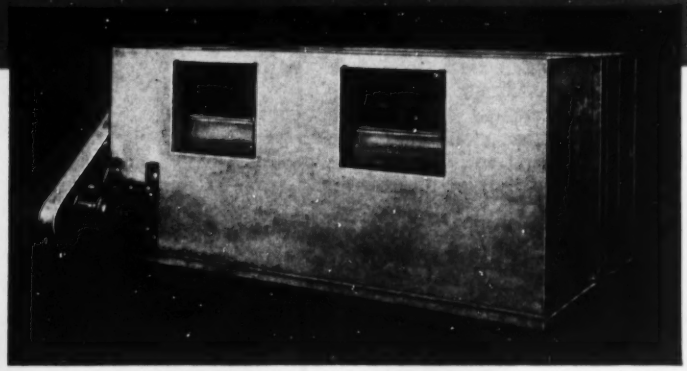

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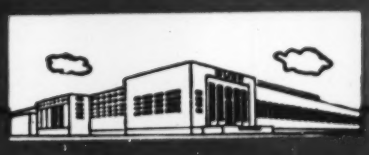

Heating Piping & Air Conditioning

Vol. 25 No. 7

JULY 1953

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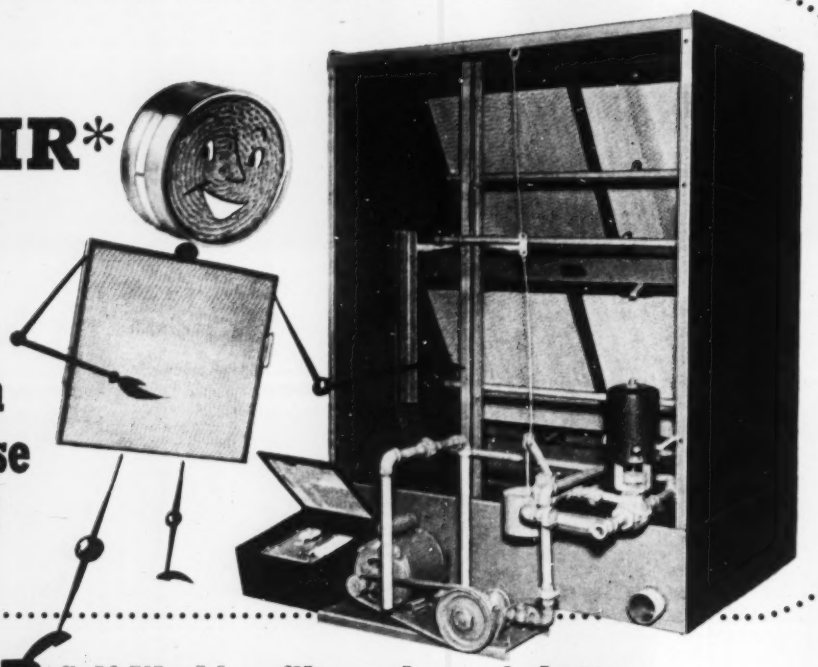

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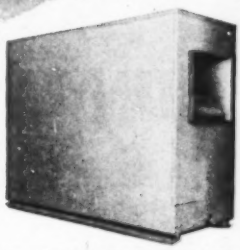

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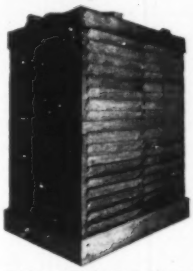

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Steel pipe distribution system.
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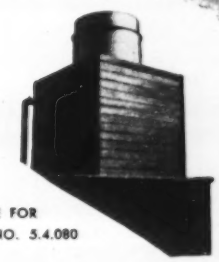
3 to 221 tons capacity.



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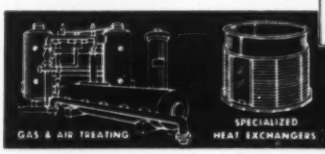

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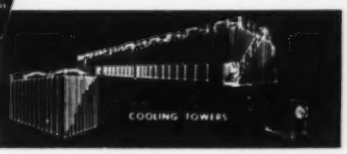

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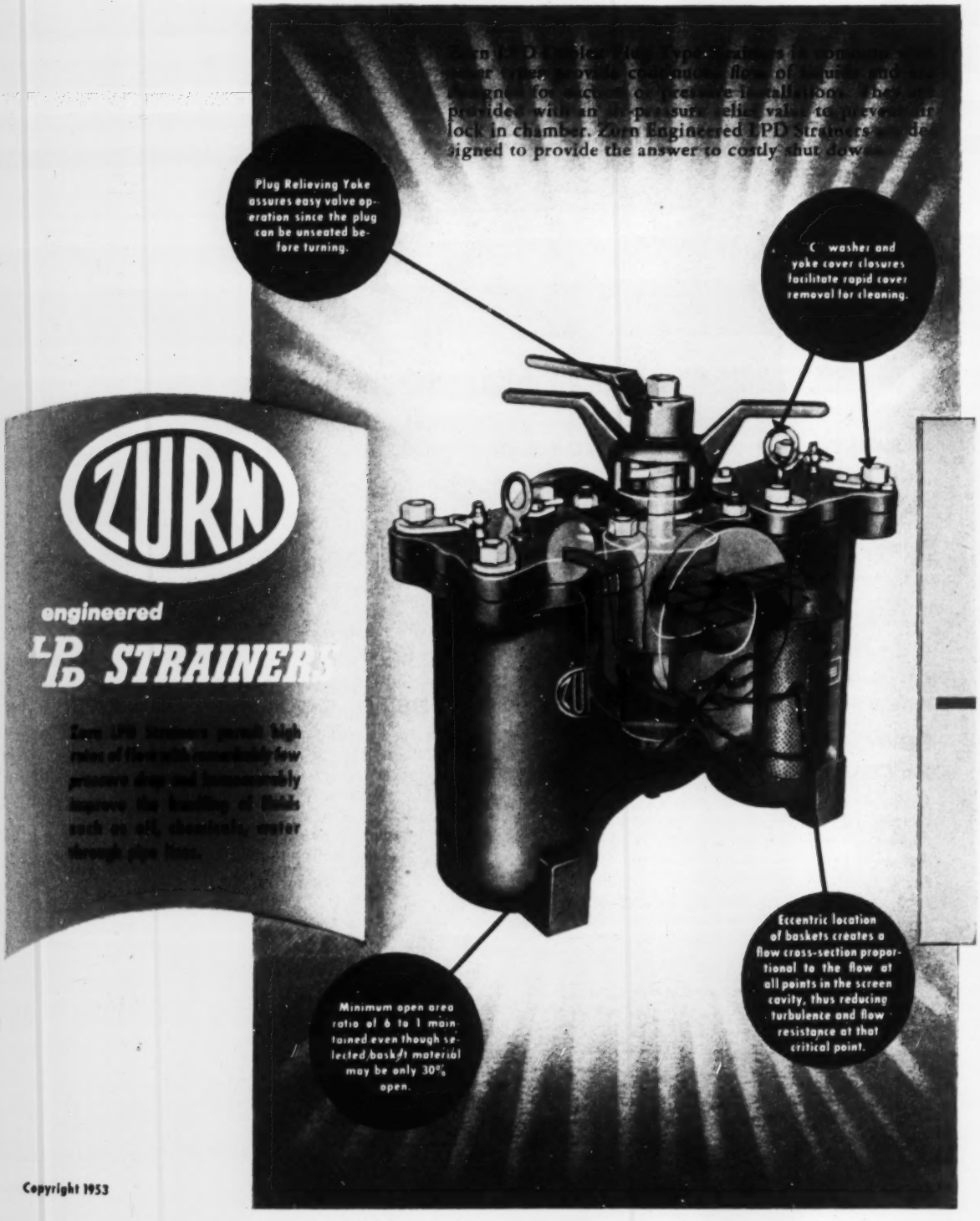
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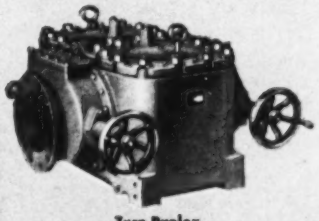

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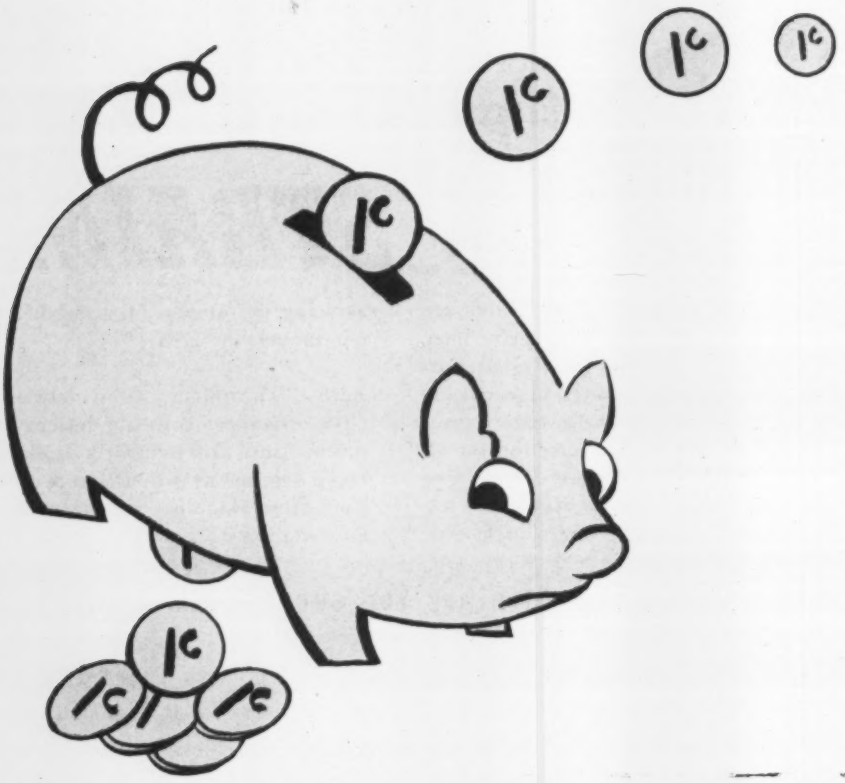

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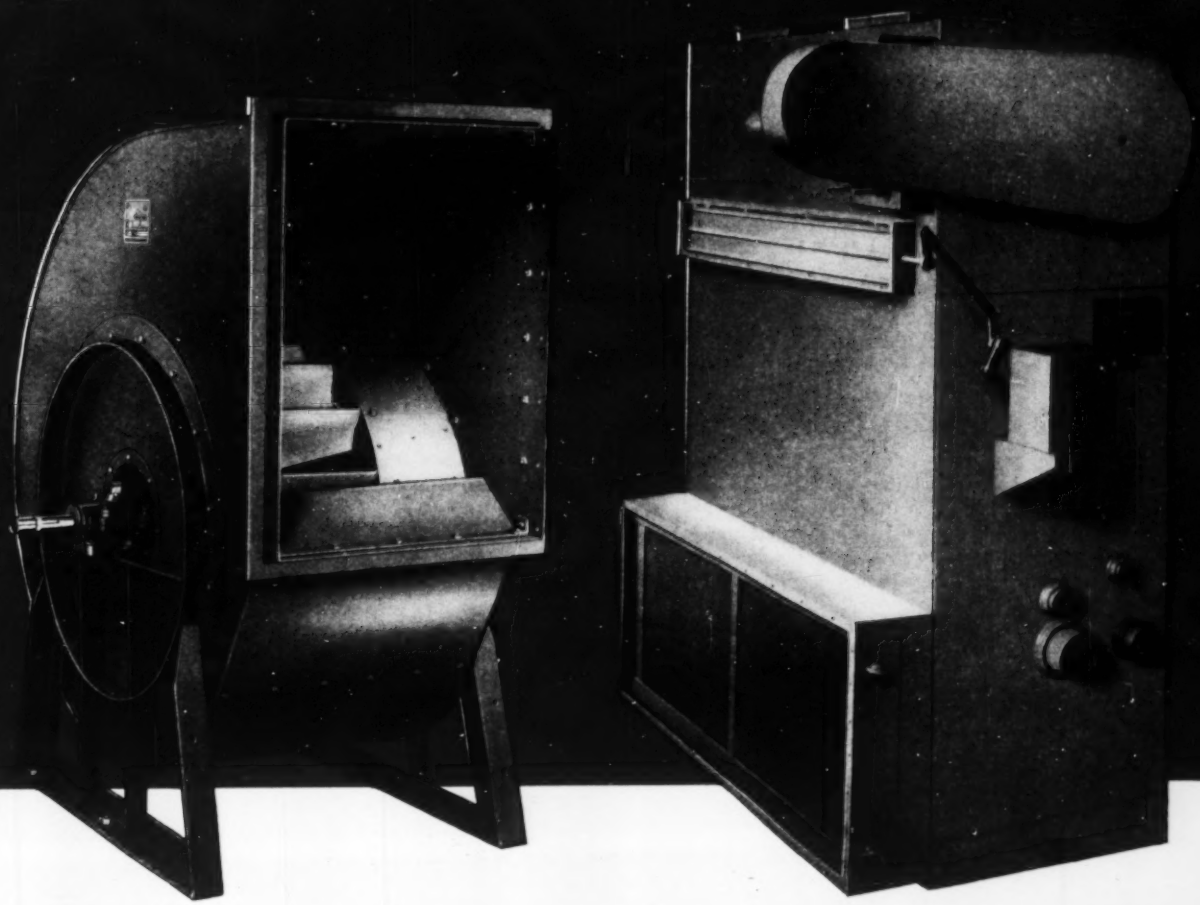

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Increased "rentability" will be an important factor in the years ahead

Lots of sun, fresh air, room for children to play—these all appeal to tenants at Meadowbrook Apartments, a garden apartment development in Indianapolis, Indiana.

And so does Honeywell Customized Temperature Control that gives each tenant *individual temperature control*, an advantage unfortunately not enjoyed by many apartment dwellers.

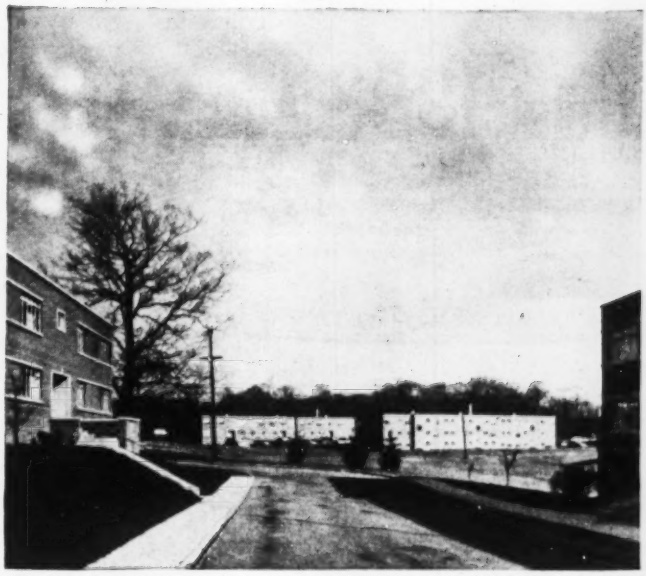
For at Meadowbrook there's a thermostat in each and every apartment.

When you talk to tenants about the heating system and the individual temperature control they enjoy, they agree both are the best they've ever known, that they're equal to what you find in the finest private homes.

And the resident manager of Meadowbrook, Henry C. Dickson, feels that Honeywell Customized Temperature Control definitely helped increase "rentability" at the time the buildings were finished.

What's more, he feels Honeywell Customized Temperature Control will give him a definite competitive advantage, tenant-wise, for years to come.

The Honeywell Thermostat in the typical apartment at right is located on the wall between the living and dining areas. Individual thermostats give each tenant *his own* temperature control as he wants it and when he wants it. Result: comfortable tenants. And comfortable tenants are satisfied tenants.



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Architect J. Lloyd Allen, above, of Allen and Kelley, Indianapolis, looks on as designer R. K. Zimmerly describes how Honeywell Customized Temperature Control helped solve a knotty exposure problem. The model shows clearly the varied exposures of Meadowbrook's 37 buildings, its 647 one- and two-bedroom apartments that are located on the 50-acre tract.

Meadowbrook was designed to give families all the convenience and comfort of apartment life, yet retain many advantages normally available only in private homes.

"It's no trouble at all when it comes to maintenance," says William D. Gill, Meadowbrook's superintendent of buildings and property.

"Tenants are happy with Honeywell Customized Temperature Control because it gives them individual comfort. But for my money it's ideal because it requires very little maintenance."

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General Controls' new 32 page catalog is a convenient and direct guide to the most comprehensive line of automatic heating controls available to the industry today. Simple, uniform throughout in format, double indexed by type number and by name, Catalog #53H sets forth the applications and specifications of 76 automatic heating controls in simple, concise, easy-to-understand terms. Additional technical information is presented in tabular form, including such items as shipping weights and instructions that expedite ordering and delivery. For your copy phone or write the General Controls Branch Office near you . . . no obligation, of course.

Typical page format—clear, easy-to-find, information arranged in standard form as shown above.

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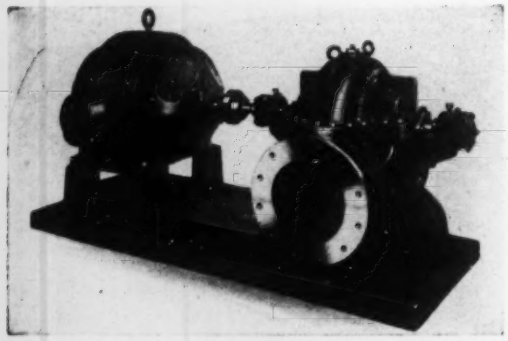
"Buffalo" Tips on Better Pumping

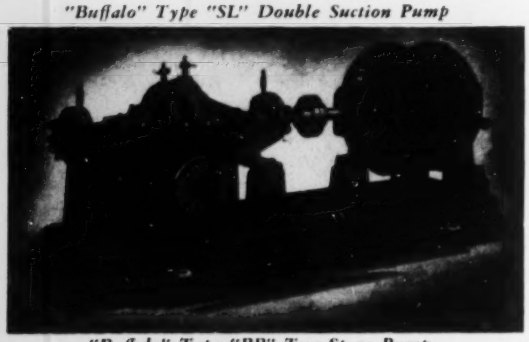
ADVANTAGES of 3 TYPES of CENTRIFUGAL PUMPS



"Buffalo" Type "SL" Double Suction Pump

DOUBLE SUCTION — EFFICIENT IN MOVING HIGH VOLUMES — IMPELLER SUPPORTED FROM 2 SIDES

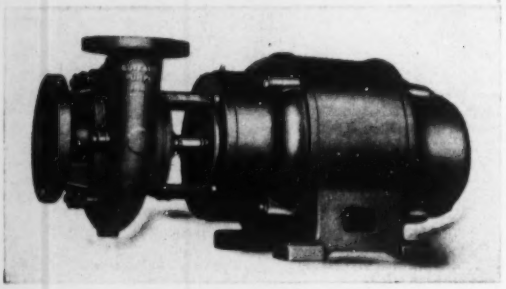
Taking in clear water from both sides of its enclosed double suction impeller, this "Buffalo" Type "SL" Pump is ideally suited to handling large volumes efficiently. Correctly formed water passages and perfect hydraulic balance add to its efficiency. Bearings on both ends of oversize impeller shaft assure maximum life. Large capacity range, from 10 to 10,000 gpm, for air washers, chilled water, humidifier, general service. Write for Bulletin 955-P.



"Buffalo" Type "RR" Two-Stage Pump

MULTISTAGE — EFFICIENT DESIGN FOR HIGH PRESSURES

"Buffalo" builds these durable, easy-to-maintain pumps in two and four stages for heads up to 1500′. Each additional stage develops additional pressure, a highly desirable feature for jobs such as boiler feed. Impeller receives ideal support from bearings on both sides. Horizontally split shell provides quick accessibility. For further details, write for Bulletin 980.



"Buffalo" Type "CCL" Pump

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Available in all iron or special alloys, these husky single suction pumps are built as a unit — require no alignment during installation or afterwards. Each design — single suction, double suction, multistage — offers particular advantages. "Buffalo" builds all types, to give you the best possible pump for your job. Write for details on the full line.

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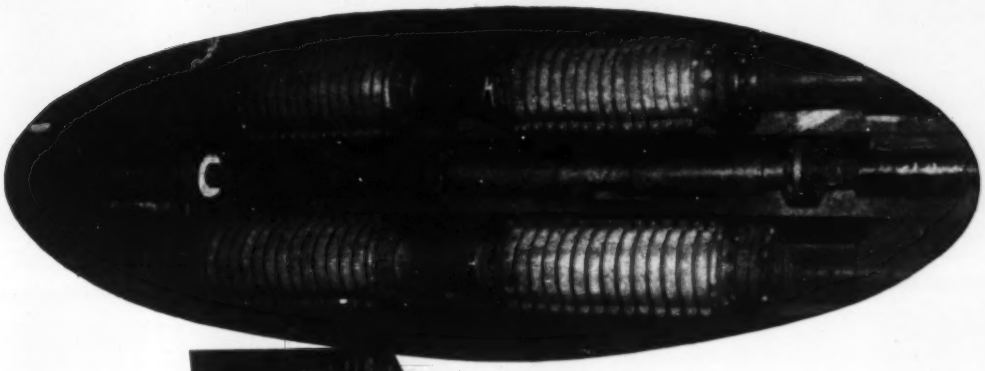

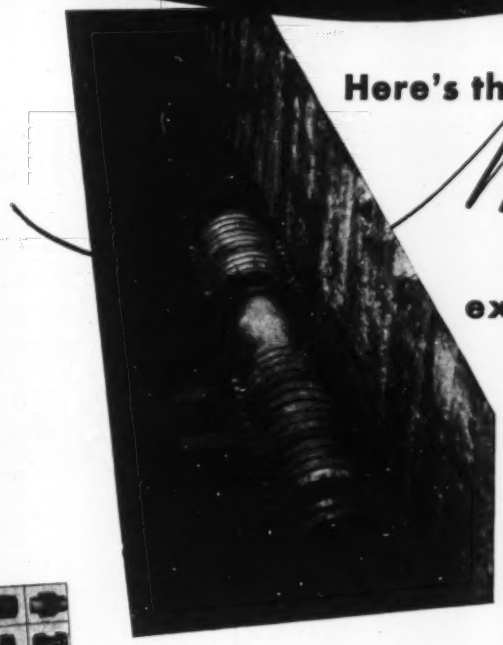

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to control piping expansion and contraction—

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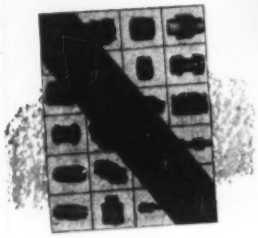
EXPANSION JOINTS

save space . . . require no maintenance . . . save time and money!



Here's your guide to PIPING MOTION CONTROL

The Flexon Expansion Joint Design Guide gives detailed specifications, and selection and application data for Flexon Expansion Joints. Write for your copy or see Flexon Expansion Joint Catalogs in Sweet's, Chemical Engineering Catalog and The Refinery Catalog.

You can have all the advantages of leakproof, maintenance-free pipeline motion control in a compact, easy-to-install, in-line unit when you use Flexon Expansion Joints. There is no repacking . . . no bulky, space-consuming installation . . . just install the Flexon Expansion Joint as easily as putting in a fitting, and then forget it.

Flexon Expansion Joints are offered with stainless steel or copper pressure carriers in Controlled-Flexing, Free-Flexing or Flexoniflex types. Units are available for pressures up to 5500 psi, temperatures to 800° F. (1600° F with special alloys). All types suitable for handling radial, axial and/or lateral pipe motion.

Write for the name of your nearest Flexonics representative.

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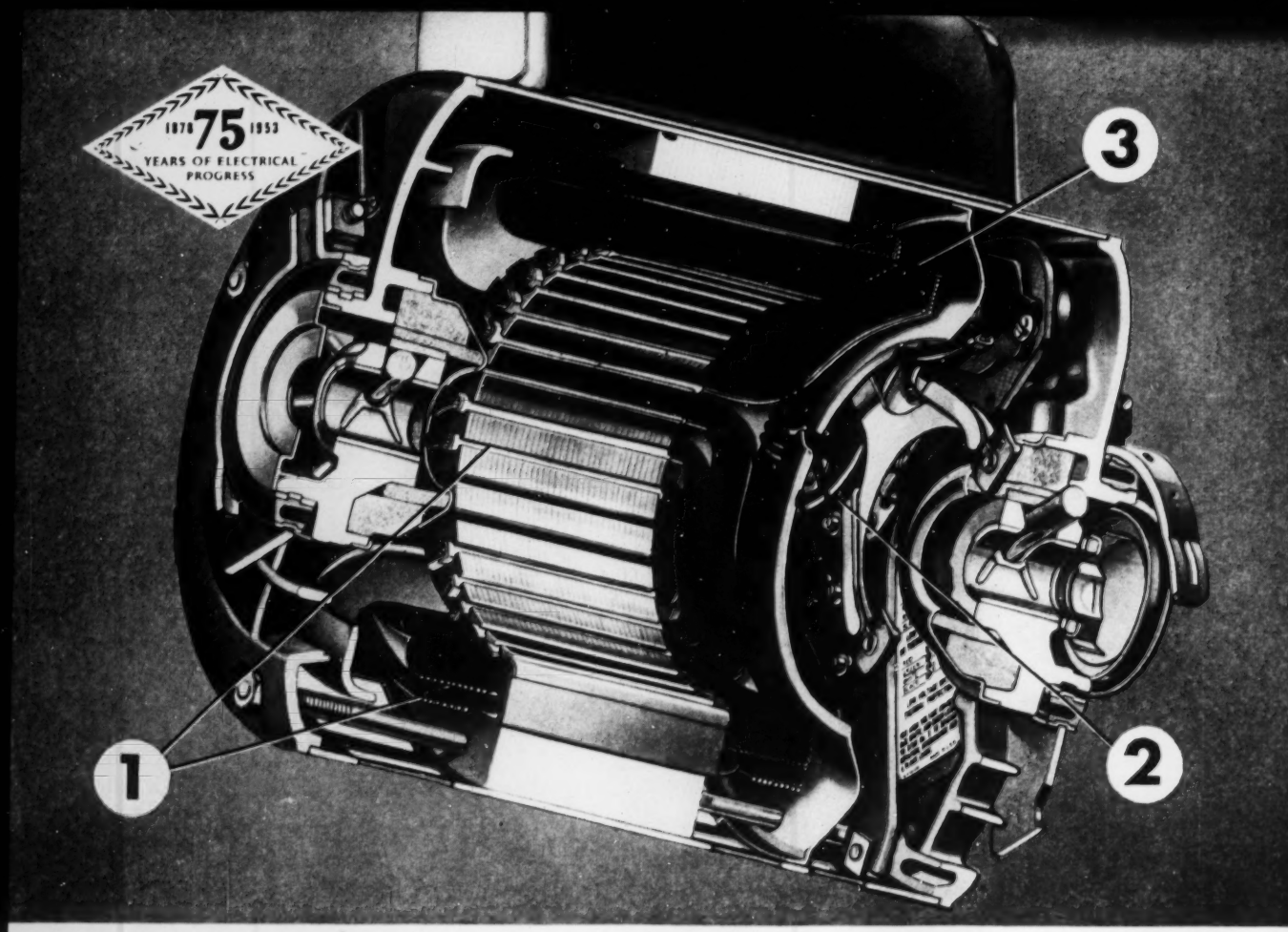

G-E FHP MOTOR CUTAWAY—The numbers shown here are keyed to the insulating materials which enable this General Electric motor to effectively withstand the harmful effects of moisture, oils, mild acids and alkalies and the results of aging.

New G-E insulation system

. . . first use of "Mylar" in electric motors

General Electric's new Fhp motor is the first to offer the superior insulation qualities of DuPont Company's "Mylar" Polyester Film. An insulator that raises the safety factor of everyday motor operation while contributing to greatly increased motor life through improved insulation. "Mylar" in combination with G.E.'s already proven Formex wire, braidless Neoprene leads and Glyptal varnish now offers you the most advanced type of motor insulation. An insulation system that means better motor protection . . . longer motor life even under abnormal conditions.

This new G-E Fhp general-purpose motor gives you full NEMA performance . . . reduces shipping and handling costs with up to 50% less weight and 40% less bulk. For complete information, contact your nearest G-E Apparatus Sales Office or write Section 702-1 for Bulletin GEA-5567. General Electric Co., Schenectady 5, N. Y.

*DuPont trade-mark

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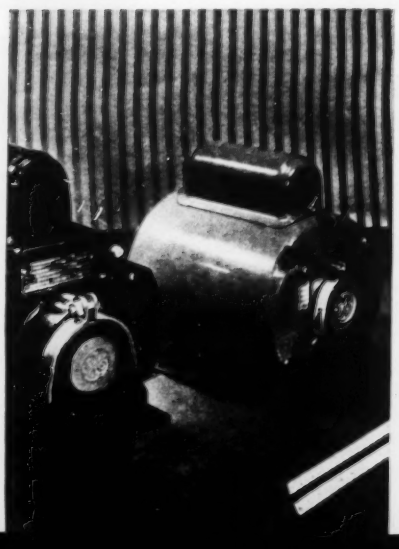

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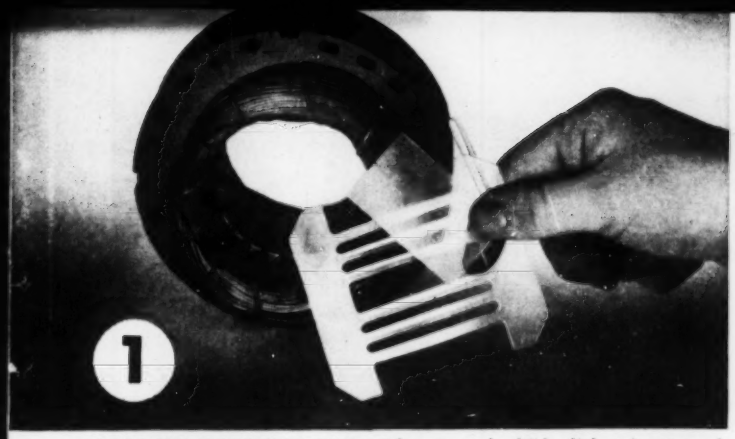
GENERAL ELECTRIC



"MYLAR"* POLYESTER FILM with extremely high dielectric strength now used for the first time in all slot, phase, and wedge insulation.

BRAIDLESS NEOPRENE LEADS of clear and permanent color retain high insulation strength and flexibility under severe operating conditions.

FORMEX WIRE PLUS GLYPTAL**** stator coating balance physical and electrical properties for top protection.

lengthens fhp motor life!

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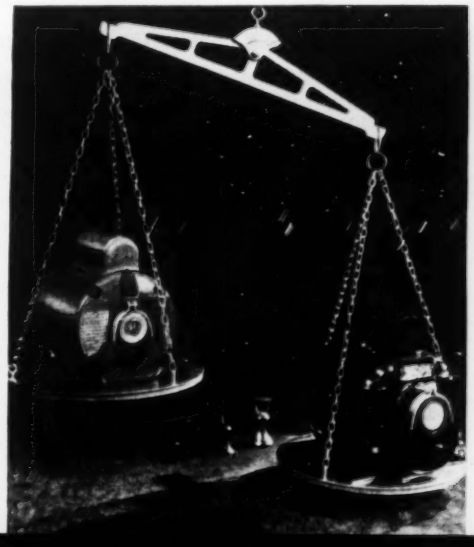
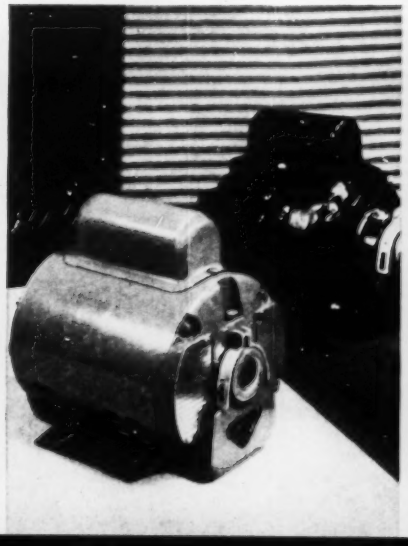
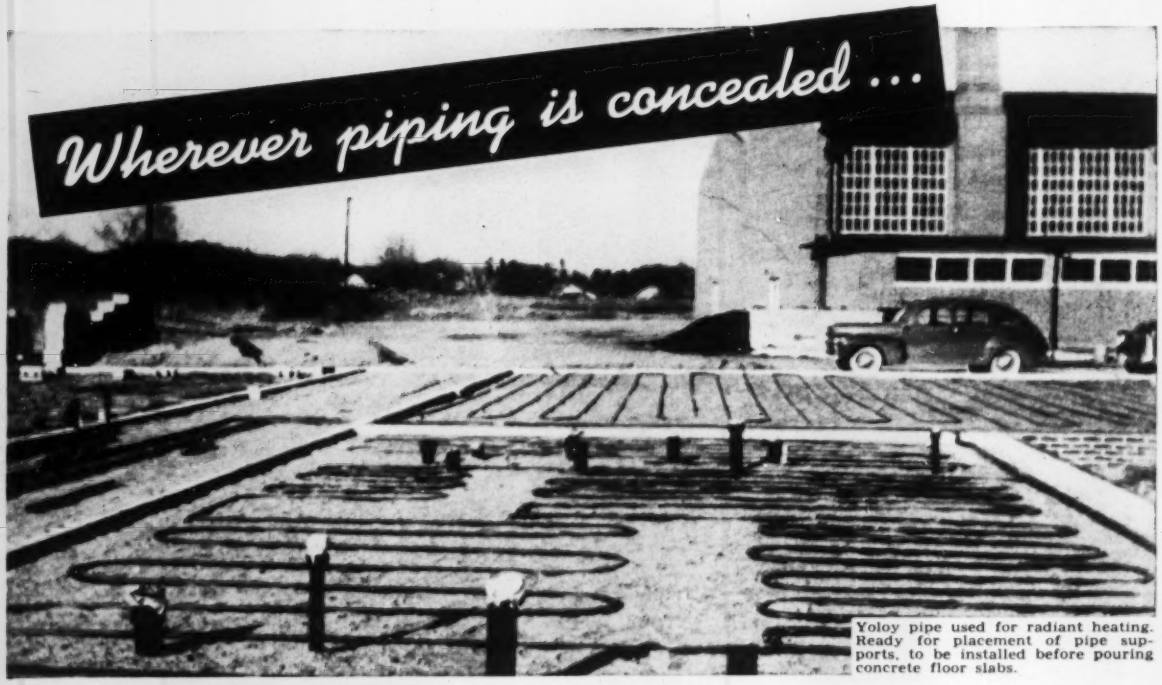


BETTER LOOKING . . .



MORE VERSATILE!

Wherever piping is concealed . . .



Yoloy pipe used for radiant heating. Ready for placement of pipe supports, to be installed before pouring concrete floor slabs.

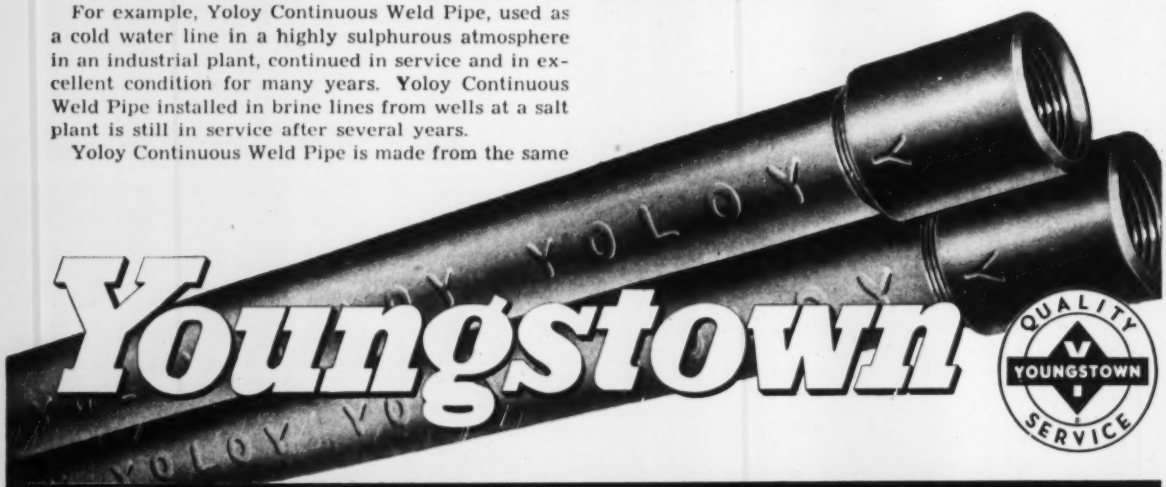
use YOLOY *continuous weld pipe*

Yoloy Continuous Weld Pipe offers distinct advantages for radiant heating and snow removal. Its use is recommended whenever piping is concealed—in industrial plants, commercial buildings, hospitals, schools and residences.

In standard tests Yoloy steel has demonstrated that its resistance to atmospheric corrosion is four to six times greater than that of regular steels. In actual installations Yoloy Pipe has demonstrated that it has a high resistance to many other corrosive conditions.

For example, Yoloy Continuous Weld Pipe, used as a cold water line in a highly sulphurous atmosphere in an industrial plant, continued in service and in excellent condition for many years. Yoloy Continuous Weld Pipe installed in brine lines from wells at a salt plant is still in service after several years.

Yoloy Continuous Weld Pipe is made from the same nickel-copper steel composition that has proved so successful in service in the oil, mining, railroad, chemical, trucking and other industries where resistance to corrosion and abrasion is of prime importance. This pipe is easy to thread and fabricate with standard pipe tools. It can be electric or gas welded readily. It has high strength and high resistance to abrasion, shock and vibration fatigue. For further information, write or phone the Youngstown District Sales Office nearest you.



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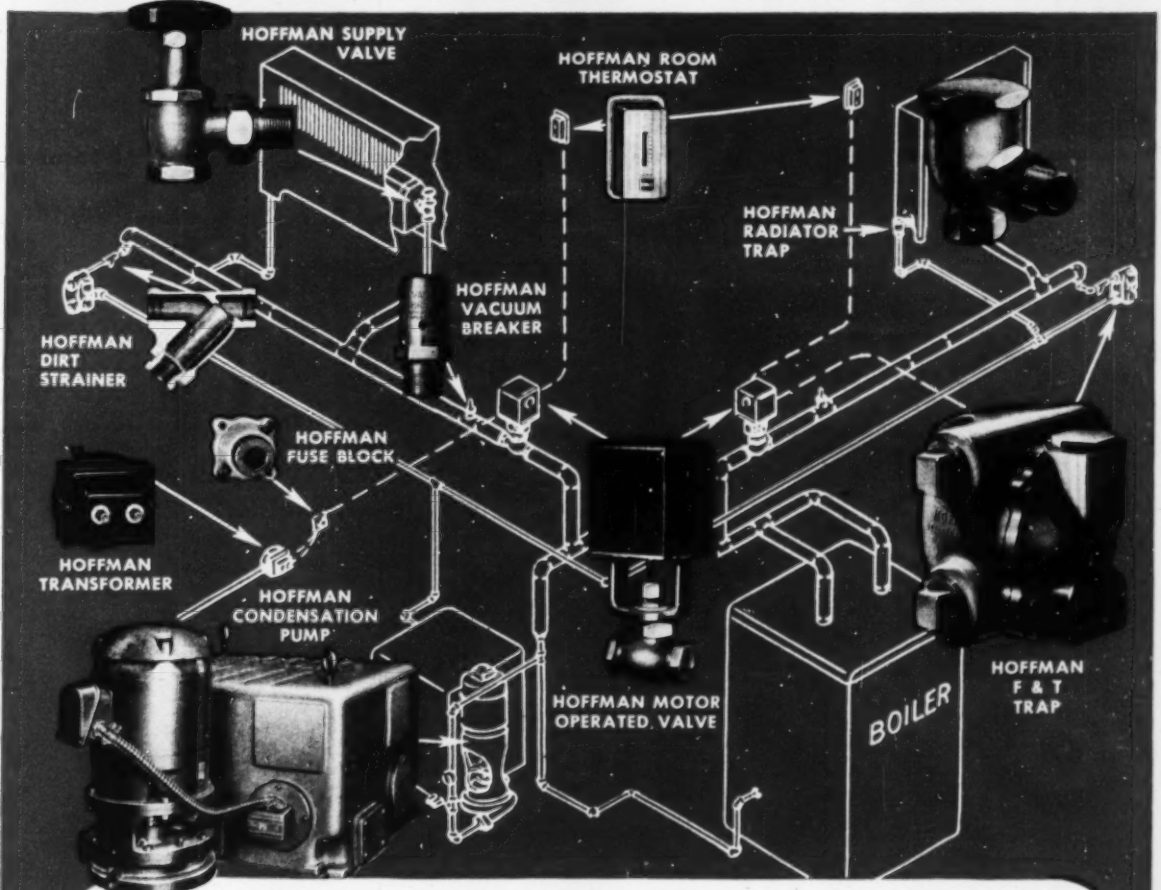
HOFFMAN ZONET

ZONE CONTROL FOR STEAM AND HOT WATER SYSTEMS



Hoffman "Zonet" Packages are available in many sizes for both steam and hot water service. Select the system required for each project from the data tables below. When selecting a zone Valve, keep in mind that it is very important to estimate as carefully as possible the maximum pressure differential across the valve. The capacity of these "Zonet" motorized valves is based upon the difference in pressure between the initial pressure side and the radiation side. Capacities are given in terms of equivalent square feet of radiation. Write for bulletin, no obligation.

Steam Capacities in Equivalent Square Feet of Radiation (240 BTU per Square Foot)

Valve Size in Inches	2# Initial Gauge Pressure			5# Initial Gauge Pressure			10# Initial Gauge Pressure			15# Initial Gauge Pressure		
	Pressure Drop			Pressure Drop			Pressure Drop			Pressure Drop		
	¼#	½#	1#	1#	2#	3#	2#	3#	4#	3#	5#	7#
½"	117	170	240	256	357	426	480	480	640	560	720	853
¾"	234	330	469	505	720	906	773	960	1,226	1,040	1,360	1,600
1"	400	560	800	880	1,226	1,520	1,306	1,600	2,080	1,760	2,293	2,666
1¼"	666	933	1,333	1,440	2,026	2,453	2,106	2,560	3,306	2,826	3,680	4,266
1½"	800	1,120	1,546	1,653	2,240	2,800	2,400	2,986	3,840	3,306	4,266	5,333
2"	1,226	1,760	2,506	2,720	3,840	4,683	4,266	5,226	6,656	5,866	7,466	9,066
2½"	1,866	2,666	3,733	3,946	5,066	6,933	5,866	7,466	9,600	8,266	10,666	12,800
3"	2,933	4,133	5,813	6,400	8,906	10,666	9,600	12,266	15,466	12,800	16,000	18,666
4"	5,866	7,200	10,133	10,666	14,933	18,666	17,600	21,333	27,200	17,600	29,332	34,666
5"	8,000	11,200	16,000	16,533	23,466	28,000	26,666	32,533	41,600	These valves will not operate against pressures over 10#		
6"	11,200	15,466	21,066	23,466	33,066	40,533	36,266	44,266	57,066			

Water Capacities in Gal. per Minute

Pressure Drop Across the Valve Measured in Feet Head of Water	Valve Sizes								
	½	¾	1	1¼	1½	2	2½	3	4
1	2.6	5.3	7.9	14	18	28	40	65	112
2	3.6	7.5	11	20	25	40	63	90	155
3	4.3	9.3	13	24	31	50	71	108	188
4	5.3	10.5	16	28	34	58	83	123	210
5	5.9	12	17	30	40	63	92	139	244
10	7.9	16	24	42	54	89	125	198	343
15	10	20	30	53	73	111	165	238	416
20	12	24	37	65	79	132	191	277	482
30	14	28	42	75	103	156	233	336	586
40	16	31	48	84	109	178	258	396	686
50	18	35	54	94	121	200	299	444	
60	19	38	59	103	132	218	306	485	

HOFFMAN STEAM AND HOT WATER SPECIALTIES

HOFFMAN SPECIALTY MFG. CORP. Dept. FG-7 1001 York St., Indianapolis 7, Ind.

VALVES, TRAPS, VACUUM AND CONDENSATION PUMPS, FORCED HOT WATER HEATING SYSTEMS Sold by leading Wholesalers of Heating and Plumbing Equipment

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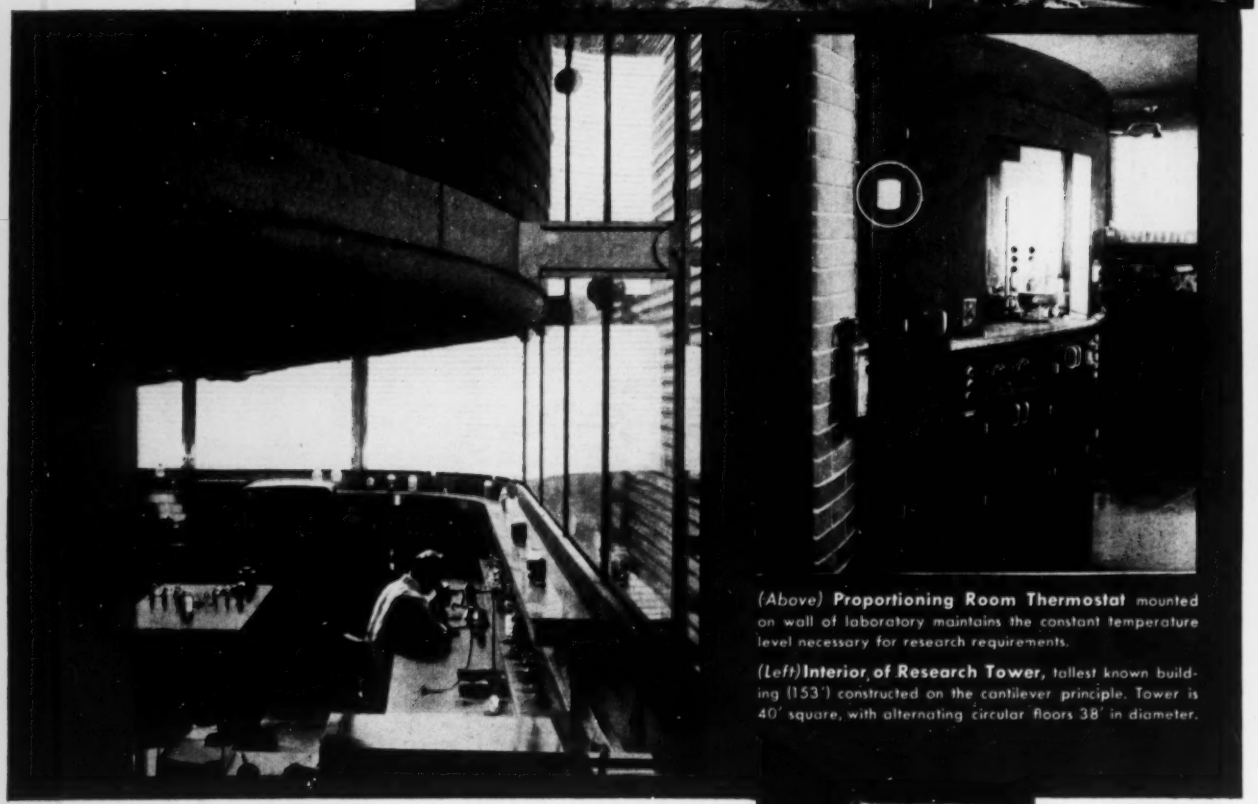
ELECTRIC Control Center

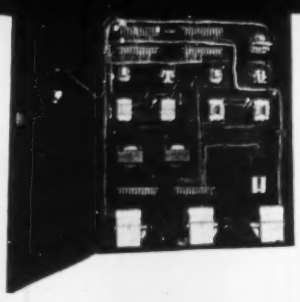
17 "Control Centers" [illegible] unique requirements of famed Research Tower at S. C. Johnson & Son, Inc.

Location: Racine, Wis. Architect: Frank Lloyd Wright. Mechanical Engineers: Samuel R. Lewis & Associates. Heating, Piping, and Air Conditioning Contractor: Advance Heating Co. Refrigeration Contractor: York Corporation. General Contractors: Wiltscheck and Nelson, Inc.



(Above) **Proportioning Room Thermostat** mounted on wall of laboratory maintains the constant temperature level necessary for research requirements.

(Left) **Interior of Research Tower,** tallest known building (153') constructed on the cantilever principle. Tower is 40' square, with alternating circular floors 38' in diameter.



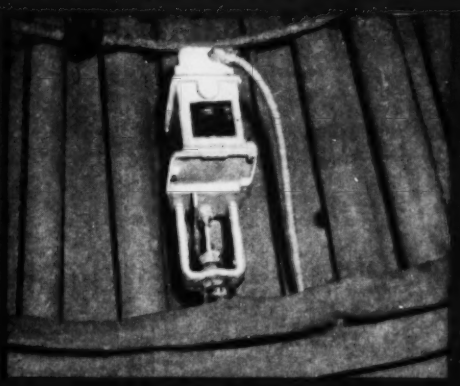
One of seventeen *"Control Center" Cabinets which house prewired relays, program motors, timers, magnetic contactors, power boxes, switches, signal lights, and terminal strips. Numbers on terminal strips correspond with numbered components, speeding installation, reducing costs, simplifying checking and revising of individual systems.*

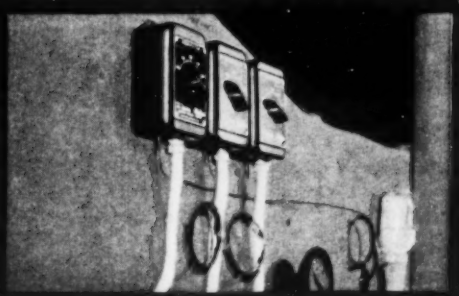
Satisfaction with a seven-zone electric control system in the modern Administration Building (completed in 1939) led Johnson engineers to specify Barber-Colman "Control Center" systems in the famed Research Tower (dedicated in 1950). Today, electric control systems for both structures are operating reliably with a minimum of maintenance and service supervision.

An extraordinary example of contemporary architecture, the Research Tower required as advanced thinking on heating, ventilating and air conditioning problems as on the cantilever principle of construction. Six static pressure controllers operate a series of exhaust dampers through electronic relays to maintain a slight pressure within the building to reduce infiltration.

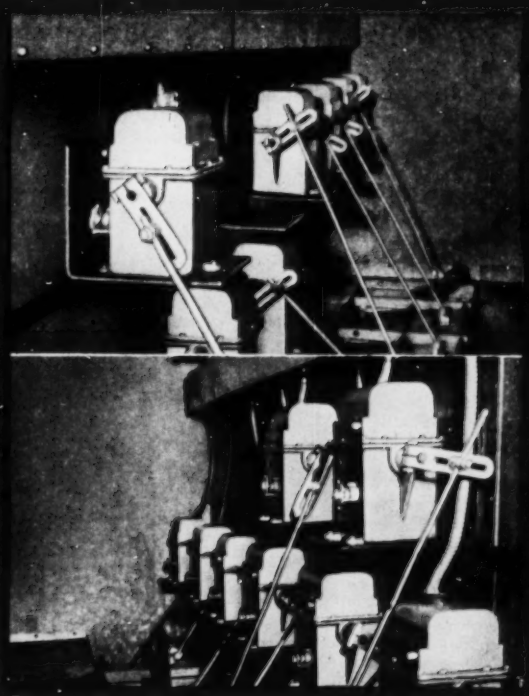
Laboratories calling for constant temperature and humidity required motor-operated proportioning valves ranging in maximum capacity from as low as 15 to as high as 1800 pounds of steam per hour. Special timers and program motors provided low temperatures and automatic coil defrosting. A total of over 400 control components was installed, wired directly to 17 "Control Centers" for handling heating, ventilating, and air conditioning requirements.

How you can benefit similarly from the timesaving, cost-cutting, advanced engineering techniques resulting from modern electric "Control Center" systems is told in a new booklet "How You Can Simplify Control Problems and Save Money with 'Control Centers'." Phone your nearby Barber-Colman field office or send coupon below for your free copy.





Motor-operated valves (above) and remote bulb thermostats (below)—typical of the over 400 Barber-Colman electric components used for temperature control in Research Tower.



Banks of Proportioning Control Motors—Job included one motor which contained a 37000 to 1 gear reduction, also quantities of two-position and reversing control motors.

BARBER COLMAN

ELECTRIC

Control Center

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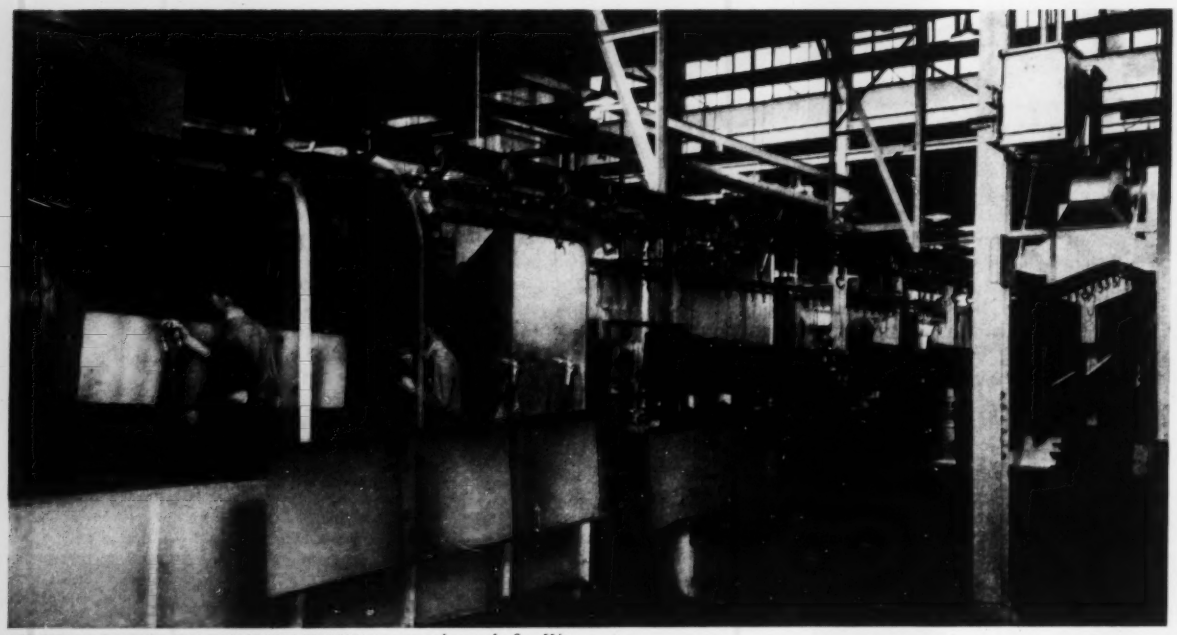
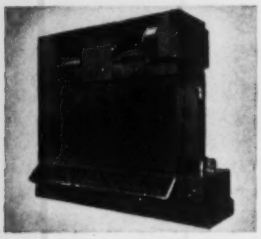


SPRAYING CORROSION-RESISTANT ENAMEL on metal panels for Worthington evaporative condensers and air conditioners. This chlorinated rubber base enamel, selected by Worthington after rigorous tests, resists chipping and long exposure to salt fog, acids, alkalis, ultra-violet light, and high and low temperatures.

FAN HOUSINGS ARE LOADED on conveyor which carries them through Worthington special 5-stage washing process. This washing, which includes sprays of Bonderite and mild chromic acid solution, prepares the equipment for the corrosion-resistant enamel.



YEARS OF TROUBLE-FREE SERVICE are assured with this Worthington evaporative condenser. The corrosion-resistant finish, rugged construction, large diameter hollow fan shaft and self-aligning ball bearings are some of the features that make this unit the finest available. You can get a Worthington evaporative condenser in any one of 18 sizes, in capacities of 10 to 150 tons.

Rustproof finish adds years to life of air conditioning equipment

For years, corrosion has presented a real problem in air conditioning and refrigeration equipment. Brine spray, water, fumes—all caused metal equipment to corrode. To combat this, Worthington engineers developed the bonderized two-coat baked chlorinated rubber enamel finish now used on all Worthington air conditioning and refrigeration units.

This finish, the result of years of testing and research, completely protects the metal against corrosion and preserves the original appearance of the equipment. Rigorous tests have shown that this finish will last at least three to four times longer than the best hot-dipped galvanizing coating.

Advances in construction and design like this are standard practice with Worthington, a leader in air conditioning and refrigeration for over half a century. From giant industrial refrigeration systems down to the air-conditioner for a baby's nursery, Worthington can handle any job, and provide exactly the right equipment. So when you think of air conditioning or refrigeration—think of Worthington.

For more information, get in touch with your nearest Worthington distributor. Or write to Worthington Corporation, Air Conditioning and Refrigeration Division, Section A.3.40, Holyoke, Mass.

A.3.40

WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

BIG TONNAGE CONTROL FOR SHELL AND TUBE COOLERS

75 to 200 TONS F-12

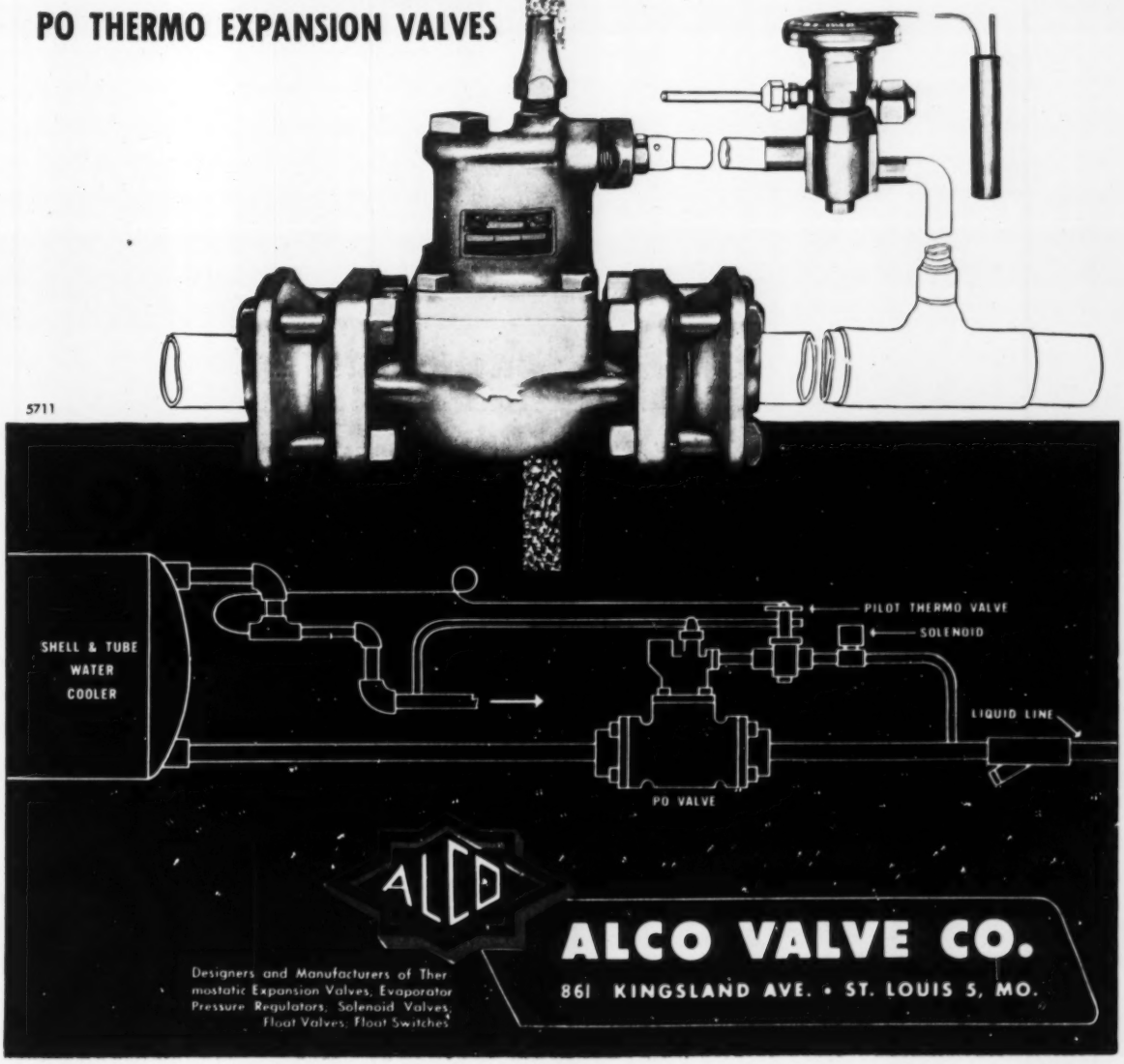
with ALCO PO THERMO EXPANSION VALVES

Alco PO Thermo Valves have only a few moving parts. Any change in superheat operates a small pilot Thermo Valve which automatically controls the PO Valve.

Both pilot and main valves have Alco's famous come-apart construction. Like all Alco products, they are easy to install and service.

May we send you FREE our PO Bulletin with complete technical information and installation data?

SEE YOUR ALCO WHOLESALER



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Designers and Manufacturers of Thermostatic Expansion Valves, Evaporator Pressure Regulators, Solenoid Valves, Float Valves, Float Switches

ALCO VALVE CO.

861 KINGSLAND AVE. • ST. LOUIS 5, MO.

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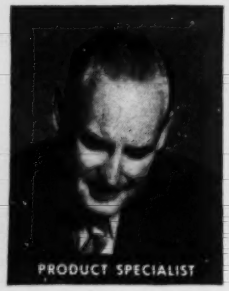
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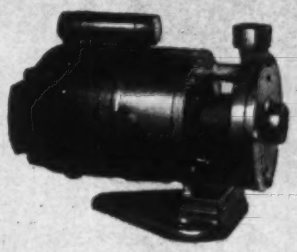
ALLIS-CHALMERS

Air Conditioning PUMPS

Easy-to-Install pumps

MEET 90% OF AIR CONDITIONING NEEDS



FHP pump

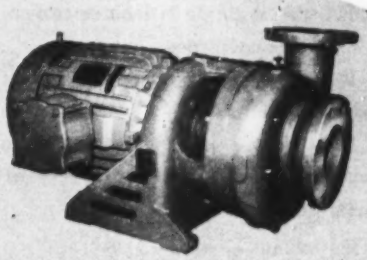
Up to 80 gpm, heads to 125 feet.

Compact pump and motor requires only two bolts for installation. Rigid construction holds alignment for longer bearing and seal life. Mechanical seal. Open impeller economy model does adequate job on many installations at very low cost. Closed impeller model for higher heads. Also available as frame-type pump for separate mounting.

Electrifugal pump

Up to 500 gpm, heads to 220 feet.

Only pump with unit-cast frame. Motor and pump are mounted on a single shaft in a one-piece rigid cast-iron frame. Alignment is rigidly held but there is plenty of space for maintenance. Installation requires only four bolts. Standard packing or mechanical seal available. Also built as frame-type pump for separate mounting.



Supporting adapter pump

Up to 2500 gpm, heads to 550 feet.

Flange motor and pump mounted on sturdy cast-iron supporting adapter. Motor and pump use same shaft. Rigidity assures vibrationless operation and long bearing life. Only four bolts required for installation. Available with standard packing or mechanical seal. Built in same ratings as frame-type pump for separate mounting.

FREE ENGINEERING HELP

YOUR ALLIS-CHALMERS PUMP REPRESENTATIVE is thoroughly familiar with pump problems in air conditioning equipment. He can offer you valuable suggestions in planning your equipment and installations. Call your Allis-Chalmers Authorized Distributor or District Office when you need help with your pump problems.

Write Allis-Chalmers, Milwaukee 1, Wisconsin, for centrifugal pump Bulletins 52B7529, 52B6140 and 52B6083 describing these air conditioning pumps.

A-3971

Electrifugal is an Allis-Chalmers trademark.

ALLIS-CHALMERS

A-B Quality

DEEPFREEZE SUB-ZERO

INDUSTRIAL CHILLING MACHINES

equipped with

ALLEN-BRADLEY TROUBLE FREE MOTOR CONTROLS

Deepfreeze Distributing Corporation's Sub-Zero Chilling Machine, equipped with two Allen-Bradley Bulletin 709 Automatic Starters.

Why are Allen-Bradley starters so popular for refrigeration and air-conditioning service? . . . Because they do not require regular attention, they are trouble free. Only ONE moving part. No pivots, pins, or bearings to corrode or stick . . . no jumpers to break. You install them . . . and forget them!

No contact maintenance . . . Allen-Bradley cadmium silver alloy contacts never need cleaning, filing, or dressing.

Dependable overload relays . . . Allen-Bradley thermal relays are dependable and remain accurate in their operation, even after long service.

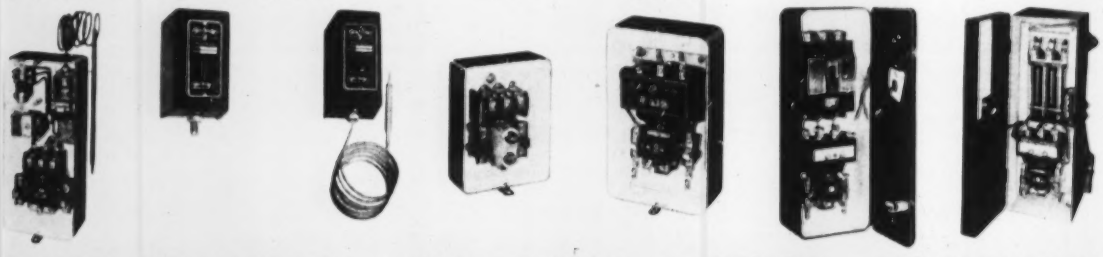
The Allen-Bradley trademark stands for millions of trouble free operations.

Install Allen-Bradley motor controls in your equipment today for rugged, reliable performance.

Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wis.

TYPICAL ALLEN-BRADLEY REFRIGERATION CONTROLS

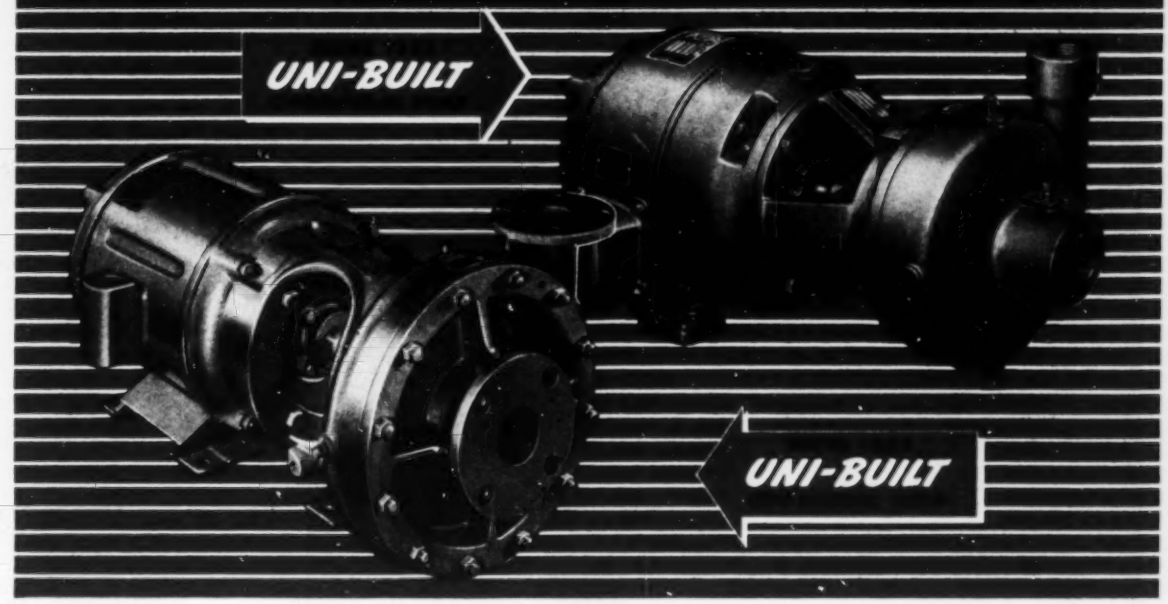
SPECIAL REFRIGERATION CONTROL UNIT | PRESSURE AND TEMPERATURE CONTROLS | MANUAL STARTER | AUTOMATIC STARTER | COMBINATION STARTER | MANUAL REDUCED VOLTAGE STARTER



ALLEN-BRADLEY QUALITY MOTOR CONTROLS

NO WAITING . . .

Popular sizes carried in stock!



Designed especially for refrigeration and air conditioning applications

Sizes, capacities and prices on B & G Series 1522 and 1531 Stock Pumps are given in a bulletin available upon request. Send today for your copy.

B & G manufactures a comprehensive line of Hydro-Flo Centrifugal Pumps, Condensers, Evaporators, Heat Exchangers and Liquid Receivers. Send for catalogs.

These are *the* pumps for your cooling tower or evaporative condenser installations! For your convenience, a stock of most commonly used sizes is maintained at the factory—ready for immediate shipment.

The leak-proof "Remite" Mechanical Seal alone makes these pumps a *buy!* This new-type Seal is harder than glass—wear-proof, corrosion-resistant. It's self-lubricating and eliminates the usual leakage through the packing gland—assures trouble-free operation.

Smooth running . . . quiet!

Oversize bearings hold the shaft in alignment for smooth, quiet performance...balancing of the impeller prevents shaft vibration and seal failure. All parts are machined to rigid specifications, carefully inspected and assembled—assurance of minimum installation and maintenance expense. B & G Series 1522 and 1531 Pumps kept in stock at the factory are bronze-fitted only, but are available as all-iron, all-bronze or stainless steel units.

With all these advantages, you'll find them competitively priced!

Hydro-Flo® REFRIGERATION EQUIPMENT

BELL & GOSSETT COMPANY

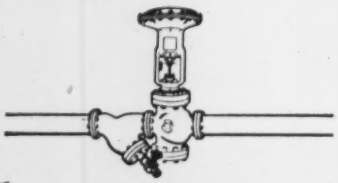
Dept. RDA-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto

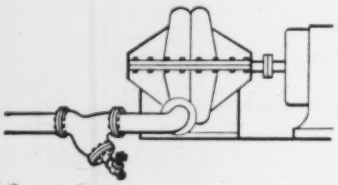
®Reg. U.S. Pat. Off.

Which of over 150 Leslie strainers is the one for YOUR job?

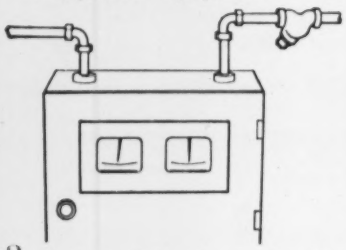
THREE "MUSTS" FOR GOOD PIPING PRACTICE . . .



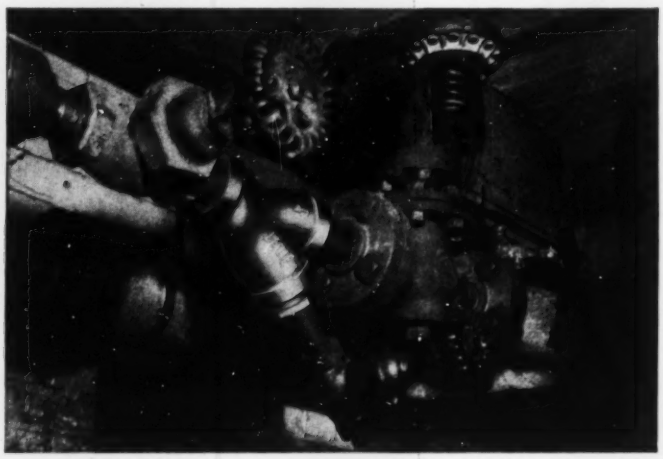
1. For protection of control valves.



2. Protection of pumps, turbines and process equipment.



3. For superfine cleaning of air, steam and liquid flows, Leslie "Poromet" filters trap particles down to .001".



WHICH WILL GIVE COMPLETE PROTECTION AT LOWEST COST?

Just considering strainer body material and screen specifications alone, there are over 150 *standard* combinations of "Y" type Leslie strainers. Each is engineered to do specific jobs under specific conditions . . . there's a "Leslie" for any industrial or marine pipeline strainer application.*

Then, with the myriad of pipe sizes and end connections, it's apparent that picking the right strainer to protect valuable equipment exposed to flow is *not* a "pin-the-tail-on-the-donkey" task

*There are standard units for pressures to 2500 psi; temperatures to 1050° F; semi-steel, cast bronze, cast steel and cast alloy steel; screwed, flanged, welding or ring-type ends; sizes from ⅛" to 1".

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soon to be released, showing strainer dimensions, pressure drop charts and pressure-temperature limit tables. Reserve your copy today. Write LESLIE CO., 237 Grant Ave., Lyndhurst, N. J.

It costs no more...

to get the right equipment for the right job. In fact, it costs less. It will pay to call your Leslie Engineer before specifying strainers... or any pressure, temperature or level control equipment. He's listed in the classified telephone directory in principal cities—under "Valves" or "Regulators."

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TRADE LESLIE MARK

THE FIRST NAME IN PRESSURE, TEMPERATURE AND LEVEL CONTROLS
Since 1900

LESLIE CO., 237 Grant Avenue, Lyndhurst, New Jersey

from the **Simplest** Single Pipe System...

to the most **Complex** Multiple Pipe Installation...

Pouring Z-Crete Insulation into forms for single pipe system to provide an insulated conduit that is strong, resilient, compact and efficient.

Conduit containing 10 pipes in typical installation. Pipes anchored to base, support blocks in place prior to pouring of Z-Crete. Low cost construction.

"Z"crete®

THE MODERN MONOLITHIC INSULATION

Insulates underground heated piping *easier, economically, permanently!*

No pipe arrangement too tough for this versatile insulation! Z-CRETE affords permanent insulating efficiency—forms a safe, solid monolithic protection around one pipe or a *dozen* in the same conduit . . . without joints or voids. Hundreds of thousands of feet of Z-CRETE have been installed in all parts of the country and in all types of soil conditions. Any number, size or arrangement of pipes can be designed into a Z-CRETE conduit. Made of inorganic, rotproof, insulating concrete—monolithic pour assures restricted water movement around the assembly. And you'll find it's usually the most economical system to install. Write for complete details today!

No Other Insulation for Underground Piping Offers All These Superior Advantages!

- **More Adaptable**—Z-Crete is entirely a field fabrication. No pre-formed sections are required.
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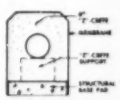
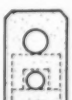
- **Readily Available**—No critical materials required. Experienced, licensed applicators, located in all parts of the country, are ready to serve you.

FOR ANY HEATED UNDERGROUND SYSTEM

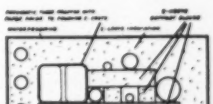


SINGLE PIPE CONDUIT

TWO PIPE CONDUIT



PIPE OVER PIPE



MULTIPLE PIPE CONDUIT

MULTIPLE PIPE CONDUIT WITH STEAM TRACER

"Z"crete®

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ZONOLITE COMPANY

135 So. LaSalle Street • Chicago 3, Illinois

Z-Crete is furnished and installed only by licensed applicators of Zonolite Company under U. S. Patent No 2355966—Canadian Patent No. 439356

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Please send FREE Z-Crete Booklet with full details and specifications about this easier, better insulation of underground heated piping.

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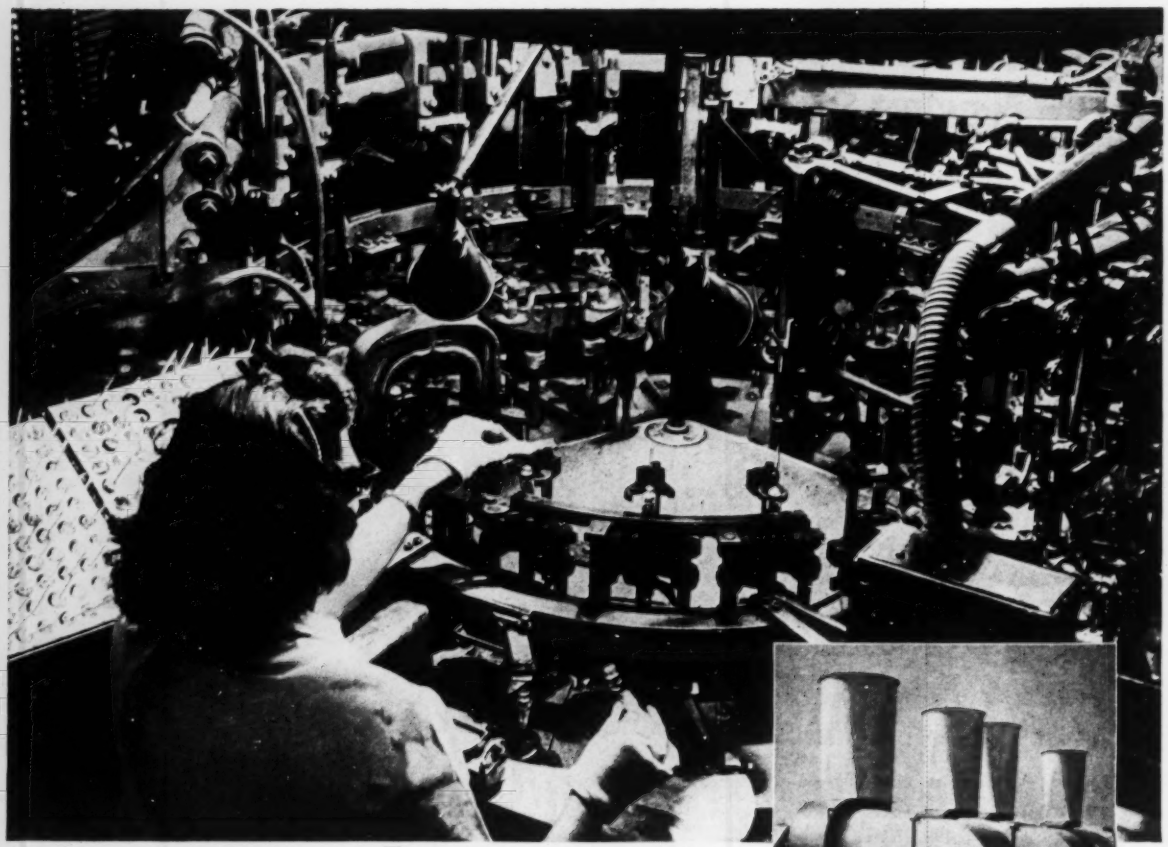
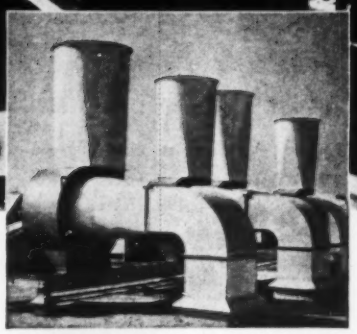


Putting Air to Work for RCA: Special machines for mass production each create 112,750 BTU's, cause special problems.



Ten Westinghouse fans exhaust the intense heat caused by flame jets and induction heating. This highly efficient Silentvane® fan does the job well, requires little maintenance.

Installed by Kirk & Blum Manufacturing Co., Cincinnati. Consulting Engineer: Paul P. Kopf, Philadelphia.

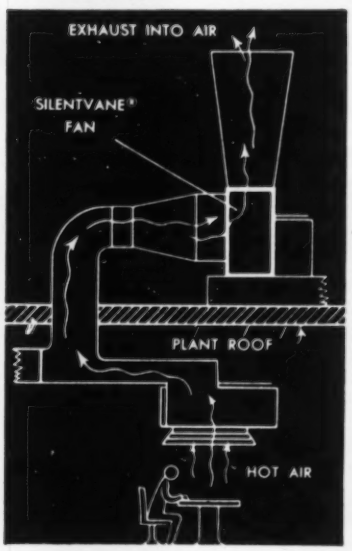
2,900,000 BTU EXHAUSTED

—OPERATORS STAY AT PEAK EFFICIENCY

Turning out miniature electron tubes is a hot business at RCA. Using a gas flame and induction heating, the process develops 2,931,200 BTU every hour. Exhausting this heat permits operators to work at peak efficiency.

Dependable Westinghouse fans handle the heat removal. They're rugged, can easily take the intense heat. And they do it quietly, efficiently.

If *you* have a heat exhausting requirement, or need ventilation for any purpose, let us help you. Westinghouse makes the most complete line of air handling, air conditioning and electronic air cleaning products available. Call your Westinghouse-Sturtevant office, or write: Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.



WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE...IF IT'S **Westinghouse**

J-80297

They Give...

PERMANENT PIPE-LINE SECURITY

From *Master* Craftsmen come the world's finest *FITTINGS* . . . drop forged from solid billets of specially blended *STEELS.*

Your pipe connections can be harmonious and lasting . . . even endure beyond the normal life of the system . . . if proper consideration is given the compatibility of their meeting. Many millions of feet of pipe and tubing have been brought together by W-S Double-Diamond Forged Steel Fittings in lasting unions against time . . . heat . . . pressure . . . turbulence . . . corrosion . . . oxidation . . . vibration . . . reduction and shock.

Such fortunate meetings withstand the adverse conditions of *ANY* service environments because W-S FITTINGS are inherently superior to those made by methods other than PRECISION MACHINING from solid FORGED stock.

Whatever your pipe or tubing application, you can profit from the permanence of W-S Double-Diamond (Screw-End and Socket-Weld) Forged Steel Fittings.

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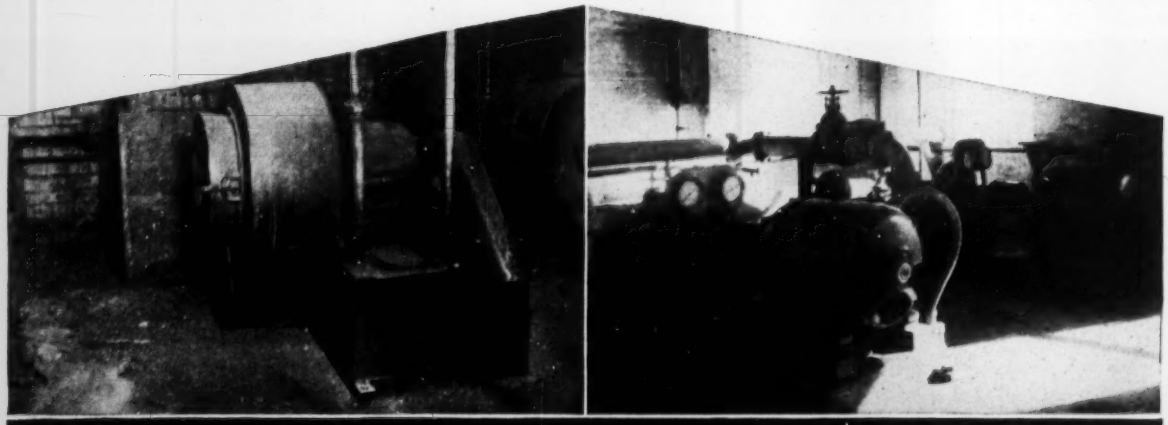


To Cut Down on Your Call-Backs...

Quiet, dependable Century MOTORS for Heating and Ventilating Equipment

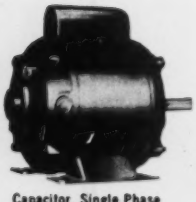
One way to save time and avoid complaints is to make sure the equipment you install has proper motor-power to operate quietly and efficiently.

To assure this customer-pleasing performance, many manufacturers equip their products with Century motors. The wide range of Century motor types and sizes allows them to select motors that are *exactly right* for every job . . . motors that bring out the best in their equipment.

For long-lasting customer satisfaction . . . specify

When you see Century motors on heating, ventilating or air conditioning equipment it's a sign that the motor-power is engineered as carefully as the product itself.

CENTURY ELECTRIC COMPANY
1806 Pine Street • St. Louis 3, Missouri
Offices and Stock Points in Principal Cities



Capacitor, Single Phase Motors
¼ to ½ h. p.

Split Phase, Single Phase Motors
⅓ to ½ h. p.

Open, Drip Proof, General Purpose Motors
400 to ½ h. p.

Splash Proof, Polyphase Motors
400 to 1 h. p.

Repulsion Start, Induction Single Phase Motors
7½ to ½ h. p.

-777

American Blower — a time-honored name in air handling

Nothing, absolutely nothing, overcomes the objections to bad odors quite as well as removing them.

And American Blower Ventura Fans (see above) do this job quickly, quietly and at low cost.

Ventura Fans, Utility Sets, Heating, Cooling Coils, and complete Air Conditioning Units are but a part of American Blower's line of quality products.

You can profit from these products. Phone our nearest branch office for data.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

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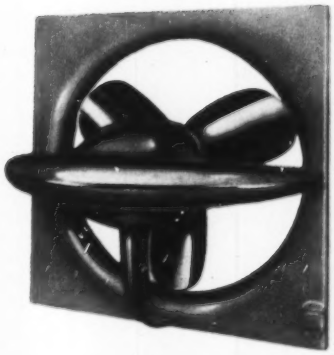

American Blower Model A Ventura Ventilating Fan. Capacities from 1000 cfm to 9700 cfm, free delivery.

AMERICAN BLOWER

YOUR BEST BUY IN AIR HANDLING EQUIPMENT

Serving home and industry

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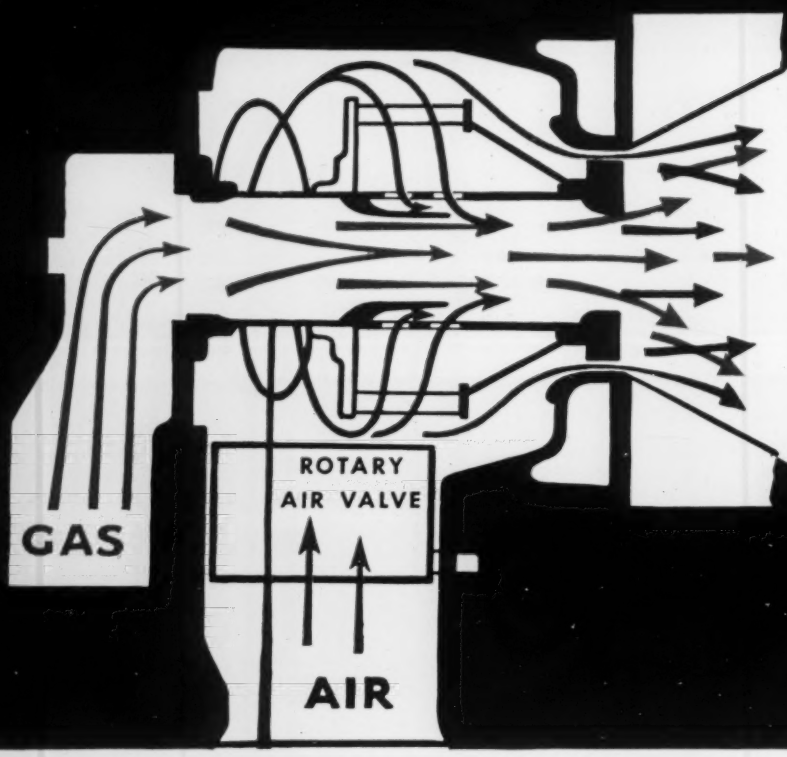


another cost-saving feature of POWERMASTER packaged automatic boilers!

The *VORIFLOW*® Gas Burner

Keeps fuel costs DOWN ... boiler efficiency UP

You can always depend on getting highly efficient and economical gas-firing with a Powermaster packaged automatic boiler because the Powermaster VORIFLOW gas burner gives you these operating advantages:

1. Infinitely Variable Combustion Modulation

Fully automatic control of fuel and combustion air responds instantly to load demands ranging from 20% to 100% of firing capacity—*with full efficiency!* There's no fuel-wasting combustion with the VORIFLOW gas burner because properly proportioned fuel and air are thoroughly pre-mixed to insure immediate ignition and complete burning upon entering the combustion chamber. All components of this unique burner are carefully sized for the Btu content of the gas supply and the heat requirements of the boiler.

2. High Efficiency Design and Construction

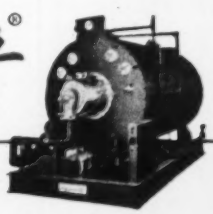
In the VORIFLOW burner, gas flows through the central gas nozzle from the gas plenum. Combustion air from the blower enters the air plenum, proportioned automatically by the motor operated rotary air valve. Primary pre-mixing air is captured by a stationary compressor wheel. This assembly directs the pre-mixing air through perforations into the gas nozzle against venturi-shaped air baffles. The gas and air are thoroughly mixed enroute through the gas nozzle. The outer air ring controls the amount of secondary combustion air admitted to the combustion chamber.

3. Immediate Change-Over to Alternate Fuels

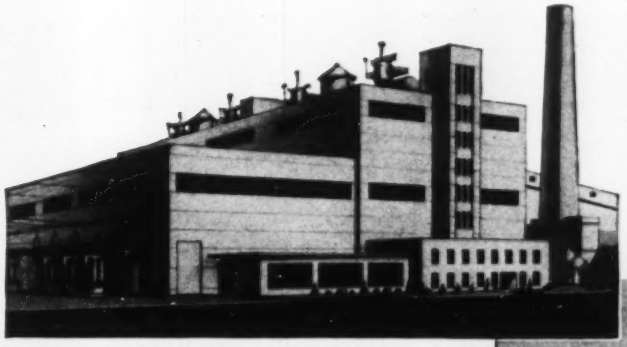
Conversion from gas to oil firing, or vice versa, with this VORIFLOW burner is accomplished in a few seconds on combination units. With the flick of an electric switch, the Powermaster modulating firing controls go into action as soon as the fuel change-over is completed. Latest development for gas firing of packaged boilers, this VORIFLOW burner is one of many reasons why Powermaster is so widely preferred for industrial plants, dairies, hospitals, laundries, schools, public buildings, institutions, and other steam and hot water boiler requirements.

Send for this new bulletin to get the full story of Powermaster's many cost-saving features.

Powermaster®
PACKAGED AUTOMATIC BOILERS
In sizes to 500 HP; pressures to 250 psi.

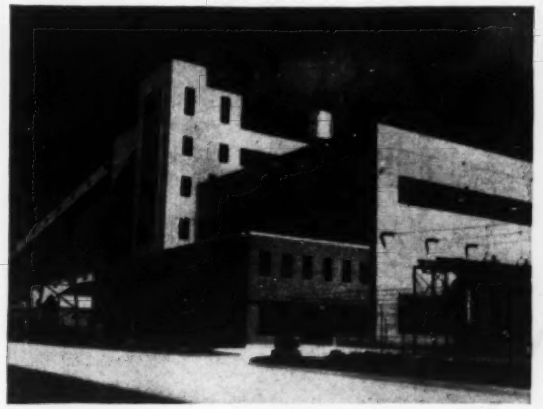


ORR & SEMBOWER, INC. • Established 1885 • **990 Morgantown Road, Reading, Penna.**

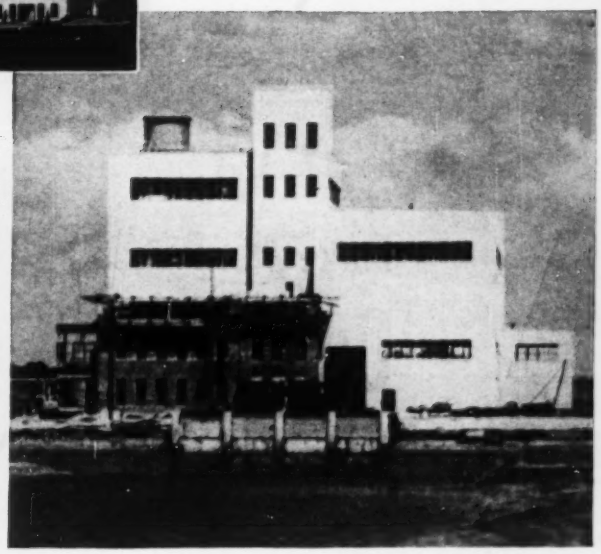


Yates Plant at Whitesburg, Georgia, was dedicated in October, 1952.

Oh, I see



McManus Plant near Brunswick, Georgia, went into service in November, 1952.



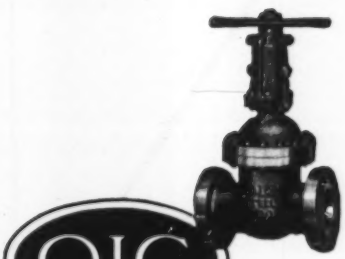
Hammond Plant near Rome, Georgia, will go into service late in 1953.

...they're using our valves at Georgia Power

Newest in their growing chain of giant power plants for expanding service in Georgia are these three plants. Indicative of their builders' desire to assure maximum dependability is their selection of OIC Valves for these plants.

Every OIC Valve is *precision-engineered* and *precision-made* to give longer, trouble-free service at no extra cost to you. OIC offers *precision-application help* in selecting valves best suited to each job.

THE OHIO INJECTOR COMPANY
Wadsworth, Ohio



VALVES . . . FORGED & CAST STEEL, IRON & BRONZE

with WALSEAL®

. . . and you can *see* that it's made right. When you make a WALSEAL joint the fillet of silver brazing alloy that appears at the face of the fitting is your assurance of full penetration and a permanently leak-proof joint that's vibration proof and corrosion-resistant . . . won't creep or pull apart under any conditions that the pipe itself can withstand.

Walseal is a registered trade-mark which identifies valves, flanges and fittings manufactured by the Walworth Company. Walseal products have *factory-inserted* rings of silver brazing alloy in threadless ports. Joints made with Walseal products are silver brazed and actually make the system a "one-piece pipeline."

Your copy of Circular 115 giving details on Walseal valves and fittings will be sent on request . . . send for it or see your nearby Walworth distributor.

SEE OUR CATALOG IN SWEET'S

Make it a "one-piece pipeline" with Walseal

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valves and fittings

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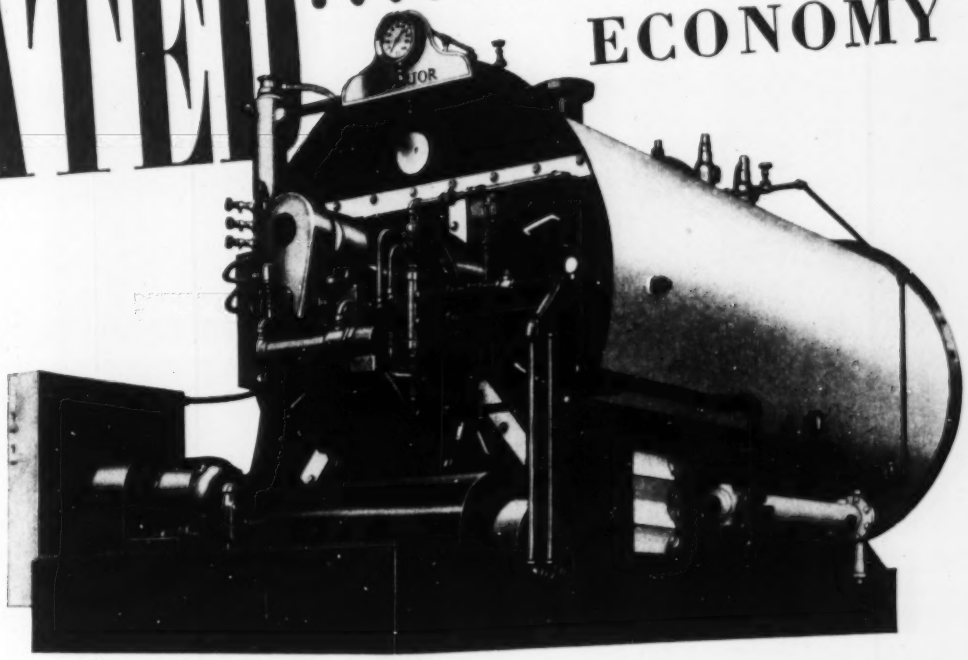

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. . . are built to maintain full capacity operation at highest efficiencies throughout a longer serviceable life. Their full 5 sq. ft. of heating surface per b.h.p. provides maximum heat transfer at normal firing rates, assuring longer life, and eliminating the excessive maintenance and high electrical costs, caused by overfiring boilers with inadequate heat transfer surface.

Superior Steam Generators are rated for actual working performance under ordinary boiler room conditions . . . not on the basis of laboratory tests under ideal conditions.

A steam generator is a long-term investment. In the course of its life, operating savings can far outweigh initial cost. Specify Superior Steam Generators and profit from their operating savings for years to come.

Superior Steam Generators are fully automatic, burn oil or gas or both . . . 18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i. or for hot water. For complete details, write for catalog 504.

for performance you can **BANK** *on*

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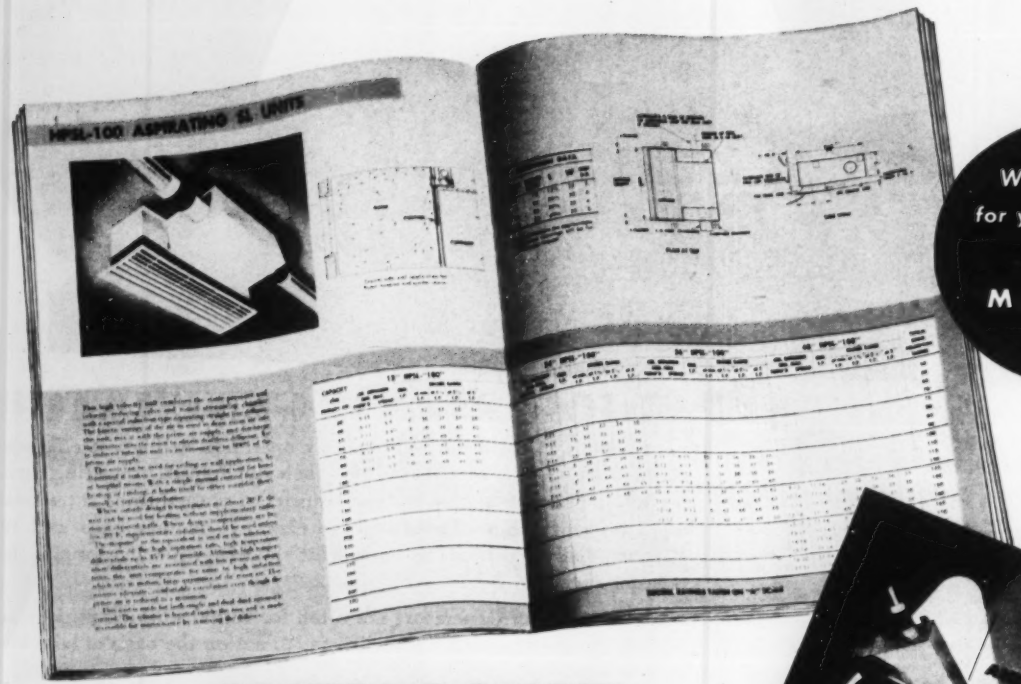
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR
STEAM GENERATORS

Here is useful engineering **Data** *on high velocity....*



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ANEMOSTAT CORPORATION OF AMERICA

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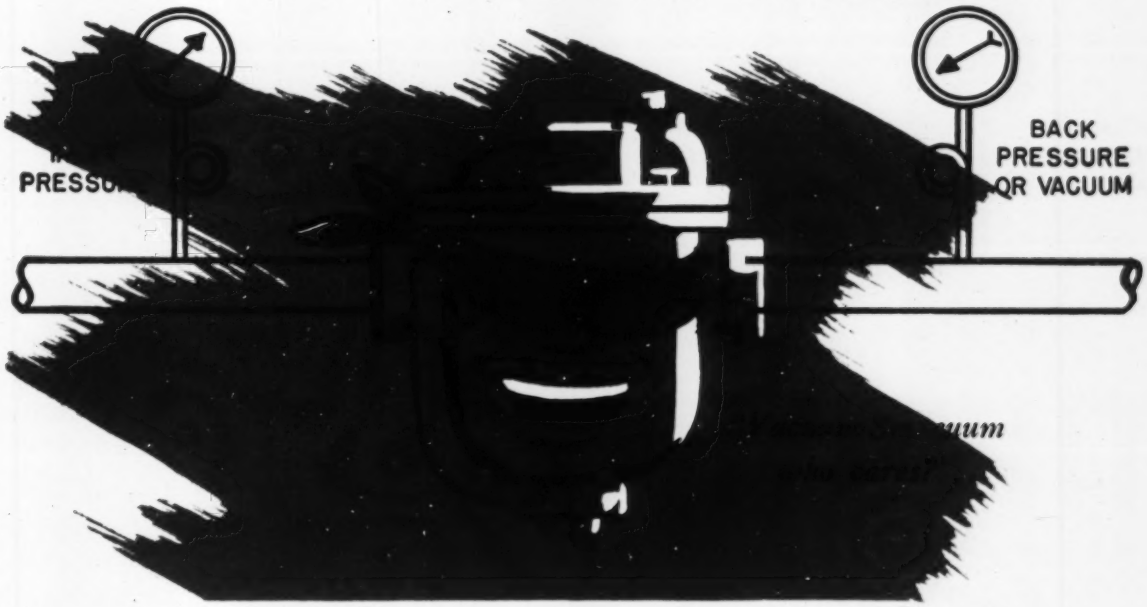
"No Air Conditioning System Is Better Than Its Air Distribution"

VACUUM ISN'T VACUUM TO A STEAM TRAP

. . . It's Just Pressure Below Atmospheric



ONLY 2½¢ per year per *trap* parts costs on traps averaging 11 years of service at Globe Steel Tubes Company, Milwaukee, Wisconsin.

***PRACTICALLY ZERO maintenance*, complete satisfaction with traps after 12 years service on 10 lbs. pressure, 5" vacuum—Liquid Veneer Corp., Buffalo, N.Y.**

***Send for 4-page Bulletin No. 223, "Vacuum Isn't Vacuum"—a complete discussion of vacuum, effect on trap selection, causes of vacuum loss, effect of flash steam, etc. Free on request. Just fill in and mail the coupon.**

BUYERS are sometimes told that steam traps for vacuum return service must be "different"—requiring, we suppose, some mysterious ability to recognize vacuum and act accordingly.

The truth is that vacuum isn't vacuum to any steam trap. It is just pressure below atmospheric pressure. All vacuum does is increase the pressure differential across the trap orifice. An Armstrong trap doesn't care whether it discharges to vacuum, back pressure or atmosphere. It works just the same in all cases.

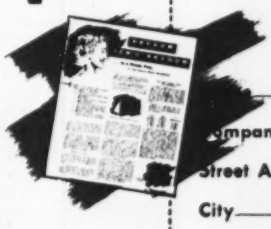
Because Armstrong traps don't have to wait for condensate to cool, drainage is fast and equipment temperatures and BTU output are maximum.

Armstrong traps won't cause you to lose vacuum. Any flash steam from their discharge is quickly condensed. *It is the leaky traps that make it hard to hold vacuum!*

The mechanisms in Armstrong traps for low pressure vacuum return service are identical in design, workmanship and materials to those used in traps for 900°F, 950 lbs. pressure. They can't help but operate a long, long time without leaking. This makes it nice for the maintenance man, too.

Fast heat-up, high temperatures, low maintenance, long life—all wrapped up in one package. Ask your Armstrong Representative to go over your vacuum heating system with you.

ARMSTRONG MACHINE WORKS
874 Maple St., Three Rivers, Michigan



ARMSTRONG MACHINE WORKS
874 Maple St., Three Rivers, Michigan
Please send Bulletin 223, "Vacuum Isn't Vacuum"

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Street Address _____

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Less than
1/5 of 1° variation in
room temperature

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Modern Radiant Heat

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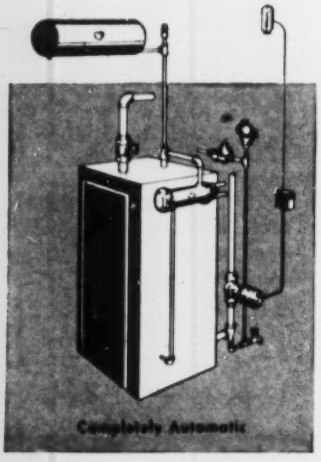
BUILDS FRIENDS FOR YOU...

WHEN YOU SELL and install the most modern and economical heating system . . . Thrush Radiant Hot Water . . . you make friends and boosters for your business. Home owners appreciate the level, unvarying temperature it provides. There's no fluctuation . . . no overheating, and radiant heat is constant . . . regardless of weather changes. Forced Circulation means positive delivery of heat to every heating unit . . . and there's plenty of hot water for kitchen, laundry or bath the whole year through. *Ask your wholesaler about Thrush Systems today or write Dept. E-7.*



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Flow Control Valve
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Thrush Water
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H. A. THRUSH
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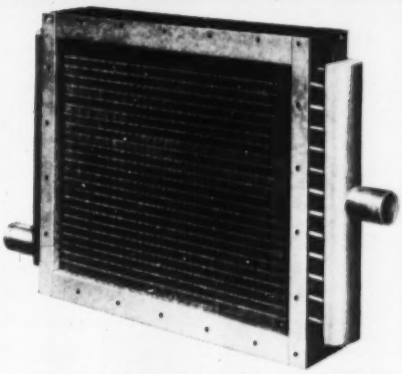
Announcing a NEW LINE of.. YOUNG HEATING COILS

These Young Features Mean Greater Efficiency Longer Coil Life

1. **Corrosion-resistant red brass tubes, staggered in multiple rows for maximum efficiency. Copper fins, heavy-wall Admiralty tubes available on special order.**
2. **Tubes mechanically expanded to fin collar to form double-wall, continuous metal transfer surface. Assures fidelity to rated standards throughout the life of the coil.**
3. **Headers formed from heavy-gauge (3/16"), hot-rolled steel with tube ends brazed into headers to insure a permanent, leak-proof joint. End support plate permits free expansion and contraction of tubes.**
4. **Heavy-gauge steel intermediate tube support formed by two cross angles welded to the tube support and the coil casing. Gives permanent reinforcement to entire coil structure.**
5. **Galvanized steel casings, with double channel top and bottom, provide support and protection for core. Flanges on four sides facilitate duct mounting and multiple bank installations.**
6. **Young steam and hot water Coil ratings conform to the proposed Standard Code of the Heating and Cooling Coil Manufacturers Association.**
7. **Young Coils offer maximum versatility in specifications due to their greater capacity range. Available in either 5 or 11 header widths, 19 tube lengths.**



TYPE "S" STANDARD

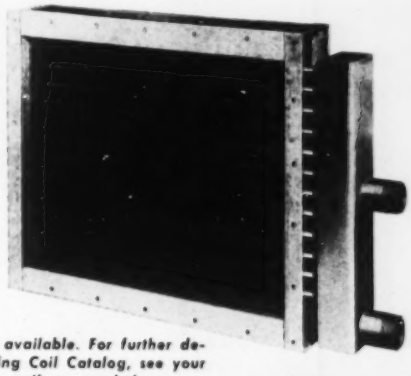
For steam or hot water service. Galvanized steel casings complete with drilled flanges on all sides for connecting to duct work, and permitting stacking in banks. Available in 11 nominal widths, 19 lengths from 12" to 120". Suitable for steam pressures from 2 to 150 psi and temperatures to 400 F. Type "S" coils incorporate Young features described at left.

TYPE "HD" HEAVY-DUTY

Recommended for severe industrial applications. Have same design features as Type "S" (above) except that the tubes are larger and of heavier-walled construction. Designed for steam pressures to 300 psi, and temperatures to 500 F. Available in 5 nominal widths, 19 lengths from 12" to 120".

TYPE "SD" STEAM DISTRIBUTING

For steam systems where performance is regulated by modulating supply of steam to coils. Double-tube feature provides protection when entering air temperatures are below freezing, and even temperature distribution along face of coil. Casing detail similar to Type "S." Available in 5 nominal widths, 19 lengths from 12" to 120". Suitable for steam pressures from 2 to 150 psi, with 25 psi recommended maximum.



Special-purpose, unencased coils available. For further details, including new Young Heating Coil Catalog, see your nearest Young Representative or mail coupon below.

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REDUCES PRICES

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Good news for users and prospective users of powder-actuated fastening!

Effective immediately, list prices on the RAMSET Tru-Set Fasteners are reduced, in some cases as much as 20%. Both light-duty drive pins and studs are included in this new move to increase the value of RAMSET SYSTEM for fastening into steel and concrete.

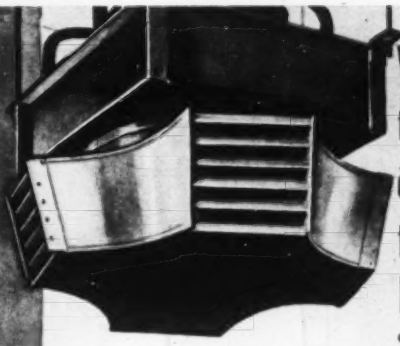
Most Versatile Line of Powder-Actuated Fastenings

Tru-Set Fasteners, with 56 sizes in 5 types to meet specific job requirements, have always offered the widest selection in the industry. Now, with these new, lower prices, and with the many built-in advantages of the Super-Speed JOBMASTER tool, users of RAMSET SYSTEM can still further cut their fastening costs.

Call your RAMSET Dealer for details on these cost reductions. And, if you are not already using the JOBMASTER, let him demonstrate its ease, speed, utility and economy.

Ramset Fasteners, INC.
Ramset Division, Olin Industries, Inc.
12117 BEREA ROAD • CLEVELAND 11, OHIO

ANOTHER Olin PRODUCT



When Temperatures Soar!...the cooling breezes from WING REVOLVING "Heaters" feel WONDERFUL!

HERE'S how to keep workers happy, and production at peak all through the hot summer days. Just turn off the steam in your Wing Revolving Unit Heaters, and turn on the fans and revolving discharge outlets. **You will be amazed at the results!!**

Summer cooling, you know, is more a matter of air in motion than of reducing temperatures. Air in motion dries perspiration and a sensation of coolness results. The frequent changes in air motion (no steady blasts) from the Wing revolving outlets keep your workers pleasantly comfortable on the hottest days. Investigate Wing Revolving Heaters now for Summer Cooling—and for complete, uniform heating next winter.

Write for folder "How to Prepare for Summer Cooling"

Wing

L. J. Wing Mfg. Co.
140 Vreeland Mills Road
Linden, N. J.
Factories:
Linden, N. J. and Montreal, Can.

MOTORIZED CHIMNEY DRAFT

with the WING DRAFT INDUCER

No boiler can operate satisfactorily or efficiently over wide ranges of weather or load with variable natural draft. The fuel—whether oil, gas or coal—must have enough oxygen for complete combustion. There must be sufficient draft or furnace fires will be slow burning and lifeless, resulting in uneven, insufficient and irregular heat.

WING Draft Inducers insure positive, adequate, uniform draft regardless of variable weather conditions or inadequate chimney or breeching construction.

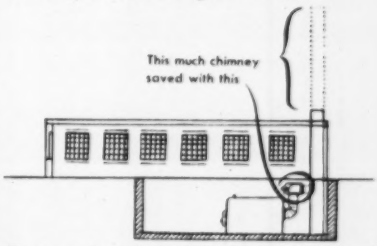


Diagram above shows how much chimney is saved by installing Wing Draft Inducers.

Wing Draft Inducers are suitable for use in connection with oil, gas, stoker-fired or hand-fired heating boilers, industrial furnaces or kilns, or high pressure steam boilers, either stationary or marine. Sizes are available for boilers as low as 1000 sq. ft. E. D. R. up to steam generators producing 100,000 pounds of steam/hr. Special, heavy duty designs available for these larger boilers.

Wing Draft Inducers are made in two types—for insertion in breeching or flue, or for installation on top of a chimney. Write for a copy of Bulletin I-52 to L. J. Wing Mfg. Co., 140 Vreeland Mills Road, Linden, New Jersey.

For projects where nothing but the BEST is desired.....
where nothing less than the BEST is acceptable....

Grant Wilson
DUX-SULATION
(ASBESTOS PROTECTED)

Maximum, over-all efficiency in both thermal and accoustical insulation. Engineered exclusively for duct application.

"Costs more, and worth it!"

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Grant Wilson inc.
ASBESTOS and INSULATING MATERIALS
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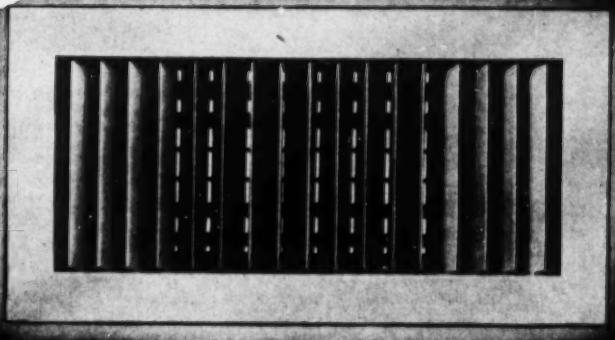
NEW ... with OPPOSED BLADE DAMPERS

SERIES 277



4-WAY Air[illegible] REGISTER

Series 277 combines 4-way directional grille with opposed blade damper. This provides both maximum directional control and positive volume control. Opposed blade dampers supply uniform distribution of air over entire grille face.

LATEST AND FINEST PRODUCT OF TITUS ENGINEERING. It stands out... by any comparison ... in its *beauty, rugged design... superior diffusion performance.*

FRAMES ... Heavy gauge cold-rolled steel. One piece.

BORDER ... 1¼" beveled edge.

LOUVERS ... Streamlined. Smooth as glass. Solid section.

LOUVER DEPTH ... ¾". Assures positive air deflection.

SCREW HOLES ... Countersunk for No. 6 screws. Spaced ½" on center from outer edge of border.

FINISH ... Gray lacquer primer as standard. Other finishes available at slight extra cost.

GASKET ... ¼" sponge rubber.

ADJUSTMENT ... Individual louver adjustment for front and center set of louvers. Opposed acting damper blades in rear are key operated.

• BRAND NEW 1953 CATALOG. Simplifies specifying. Provides all engineering data you need.

REQUEST YOUR FREE COPY NOW, including all specification and engineering data plus facts on construction, performance and selection of outlets.

CHECK TYPE OF GRILLE ON WHICH INFORMATION IS DESIRED

- ☐ Air conditioning outlets
- ☐ Return air grilles and registers
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- ☐ RUSH information on Series 277.
- ☐ Send complete New 1953 catalog.
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All Equipped with Detroit Stokers.

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Red Wing, Minnesota has a very high percentage of Detroit Stokers in comparison to the population of 10,000 people.

Red Wing Burns Coal—the Basic Fuel with Detroit Stokers because they are always dependable, economical.

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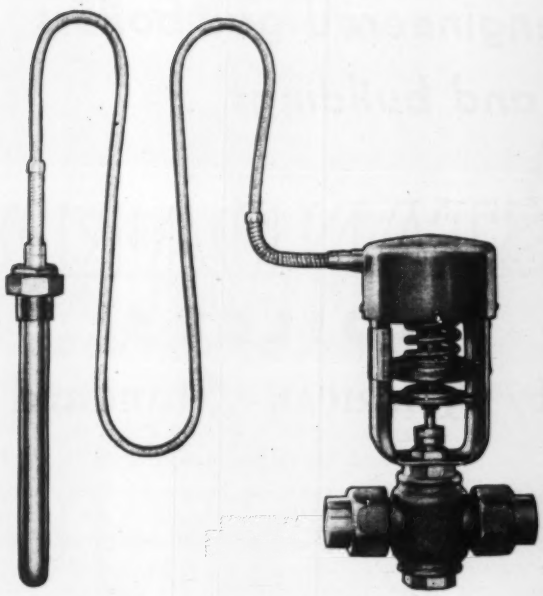
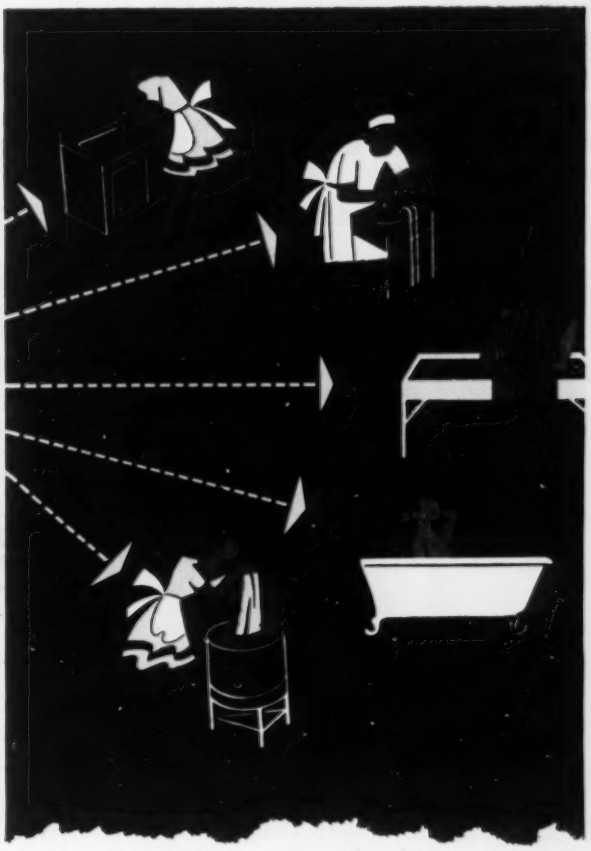


Sylphon Temperature Regulator No. 999 —fully modulating; automatic



Real help for hot water users!

● Having a continuous supply of uniform temperature hot water from storage is easy—when you have Sylphon Temperature Regulator No. 999 on the job. It's ideal for apartments, offices, hotels, institutions and industrial plants. Fully modulating, it maintains constant, "set" temperature. Operates automatically, eliminates manual control. Self-contained and self-powered, No. 999 requires no auxiliary power source. It does not cease to function in the event of line or compressor failures.

No. 999 has many features that assure years of reliable, economical performance. It has stainless steel frame for minimum heat conduction from valve to regulator head. Neat and compact, it has less height and weight than other types. Its 2-ply Sylphon bellows provides added power. The *No. 999-T* model has a dial indicating thermometer, for added convenience.

Besides its use with storage water heaters, No. 999 is also recommended for many industrial applications such as metal plating tanks . . . bottle washers . . . treaters . . . slashers, etc. Write for Catalog NH-A.

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Temperature Controls • Bellows Devices • Bellows Assemblies

FULTON SYLPHON
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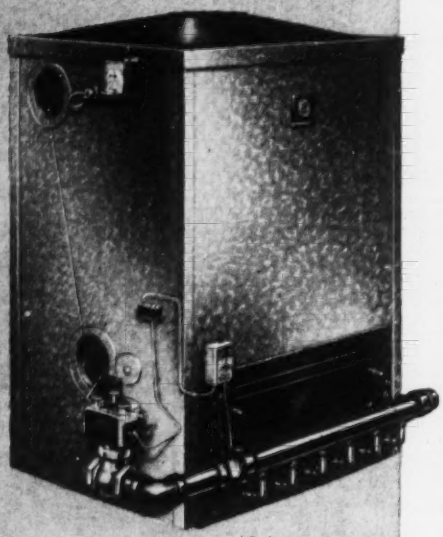
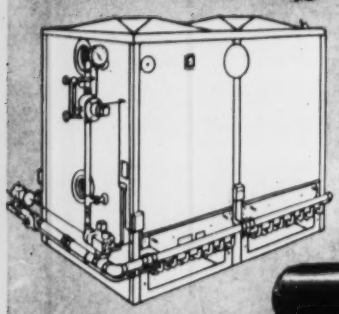
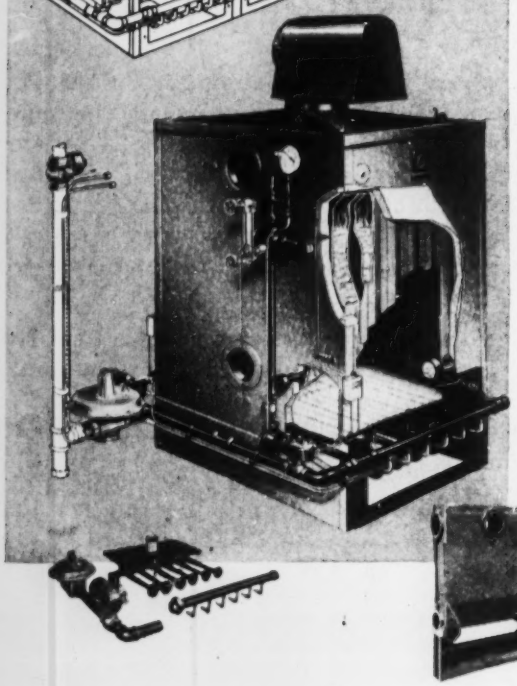
Quality-built, precision-engineered gas boilers for large homes and buildings





Available in two types and 25 SIZES



STANDARD BOILERS by AMERICAN-Standard

■ Made specifically for gas firing, Standard boilers embody the most modern engineering developments for efficient, completely automatic heating with lowest operating and maintenance cost.

Available in two types and twenty-five sizes, they cover practically every heating requirement for large homes, apartment buildings, hospitals, and various commercial and industrial installations. They can be used in batteries in larger buildings to provide an extremely flexible heat source through the operation of one or more units, thus giving added economy in mild weather, as well as perfect comfort in the coldest weather.

These construction details tell you why Standard boilers are better

PINTYPE SECTIONS of durable cast iron. Flue surfaces are studded with projections which absorb maximum heat from rising gases, transferring this heat to boiler water. Machine-ground surfaces require no cement where they're joined.

AUTOMATIC GAS VALVE is operated electrically by room thermostat. Regulates gas flow according to steam pressure or water temperature of boiler. Has sure-acting mechanical upper limit. Can be manually operated.

AUTOMATIC PILOT prevents flow of gas to main burners if pilot goes out. Special control for 100% safety shut-off for LP-gas and butane-air gas.

EFFICIENT BURNERS are precision-made for quiet, economical operation with each type of gas.

VENTURI MIXER TUBE induces proper velocity to gas and primary air, and obtains correct mixture of gas and air.

Sub-assembled and Easy to Install

Cast iron sections are precision-machined to facilitate quick and easy assembly. Individual sections may be conveniently carried through any ordinary doorway. To save further time and labor, controls, valves, and control piping are factory-assembled as far as practicable.

American Radiator & Standard Sanitary Corporation
P. O. Box 1226, Pittsburgh 30, Pa.

AMERICAN-Standard
HEATING

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS

SPECIFY

SPORLAN LMC

and get

PEAK PERFORMANCE on all Flooded Systems

with the

Sporlan LMC

LIQUID MASTER CONTROL

Again Sporlan offers you a NEW FIRST!...

A Positive Liquid Level Control for Ammonia, Freon-12, and Freon-22 with all these features!

First, the Sporlan LMC consists of a standard Sporlan Thermostatic Expansion Valve equipped with a matched Sporlan Level Master Element. That means that the liquid level control and the expansion device are combined into one unit, and you have a choice of Sporlan Thermostatic Expansion Valves for Freon-12 and Ammonia up to 100 tons, and for Freon-22 up to 180 tons... *thus no job is too large or small for the Sporlan* **LMC.** *Existing flooded systems can be easily and economically modernized and made automatic with the Sporlan* **LMC.** *The Sporlan* **LMC** *provides a* MODULATED FLOW *and maintains practically a static liquid level in the low side! The Sporlan* **LMC** *insert bulb has* NO MOVING PARTS!

Any two wire power supply of 115 or 230 volts, any frequency AC or DC, is adequate. The Sporlan LMC insert bulb can be installed in either a horizontal, vertical or angle position for direct contact with the refrigerant. If the liquid level drops, a heater element in the bulb acts as an artificial superheat increasing the pressure in the thermostatic element, thereby opening the valve. If the liquid level rises, its refrigerating effect on the bulb overcomes the heater, and the valve throttles.

The Sporlan **LMC** *is* NOT *affected by turbulance... tight closing* IS *assured... there is no current flow through refrigerant... and only proven thermostatic expansion valve performance is employed!*

WRITE TODAY FOR COPY OF BULLETIN 60-15...
THEN SPECIFY SPORLAN LMC FOR ALL YOUR FLOODED JOBS!

Buy Sporlan Right Down the Line

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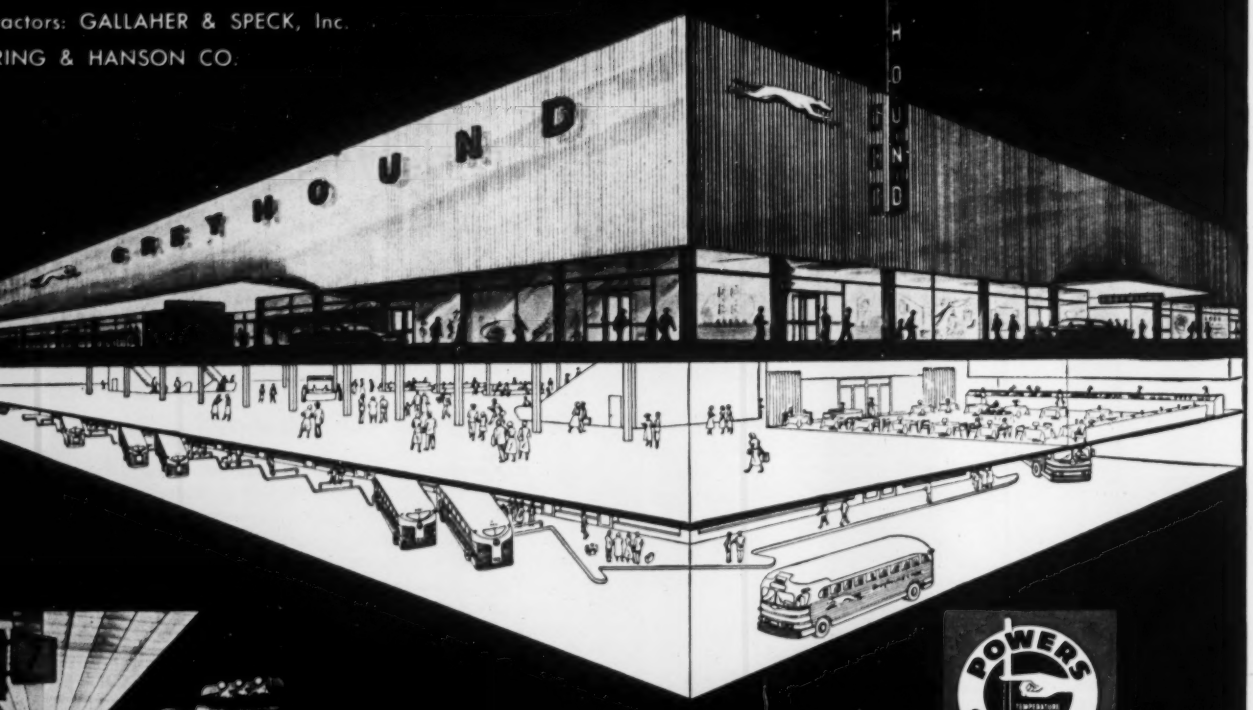
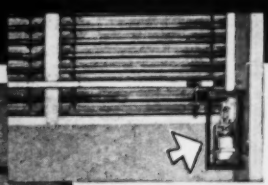
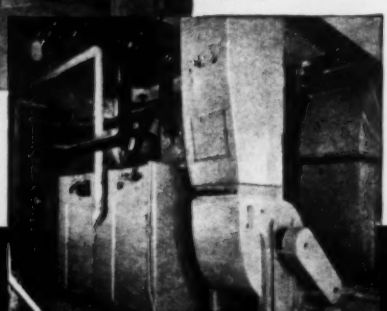


POWERS CONTROL



Above:
18 Smoke Vent Louvre Dampers in Bus Loading Concourse are controlled by 6" POWERSTROKE motors.

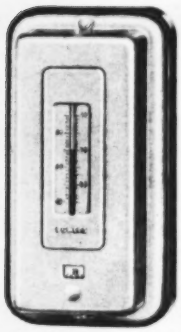
Some of the more than 20 supply and exhaust fans with a total capacity of 500,000 cfm which are Powers controlled.



in Biggest Privately Owned Bus Terminal

is assured by a

POWERS PNEUMATIC SYSTEM OF *Control*



Type D Thermostat

Greyhound Corporation's new up-to-the-minute $10 million bus terminal in Chicago is completely air conditioned. The two million passengers yearly, estimated to use this building, will find every modern convenience and comfort.

On the top two levels, is a public parking space for 500 autos. On the street level and the waiting room level are 13 stores and shops, 7 restaurants and other spaces, which are air conditioned and Powers controlled.

On the bottom level is the Bus Loading Concourse with 31 platforms for arriving and departing buses. Its ventilating system has a capacity of 180,000 cfm which creates a continuous 5 mph breeze. Here 18 Smoke Vent Louvre Dampers are controlled by 6" POWERSTROKE motors. In case of emergency the dampers can be opened by 3 manually operated positive switches each strategically located in a glass covered cabinet.

Domestic Hot Water Supply for the building is furnished by steam heated storage heaters controlled by Powers No. 11 Temperature Regulators. Shower Baths thruout the building are each regulated by a Powers Thermostatic Water Mixer.

Experience gained by Powers here and in many other important large and small buildings will be helpful to you. Next time a temperature or humidity control problem arises, contact POWERS nearest office. There's no obligation.

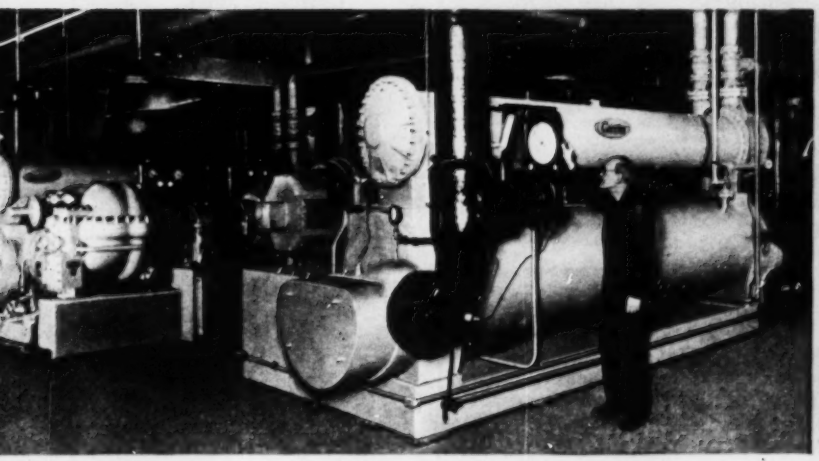
THE POWERS REGULATOR CO.

Skokie, Ill. • Offices in Over 50 Cities in the U.S.A., Canada and Mexico

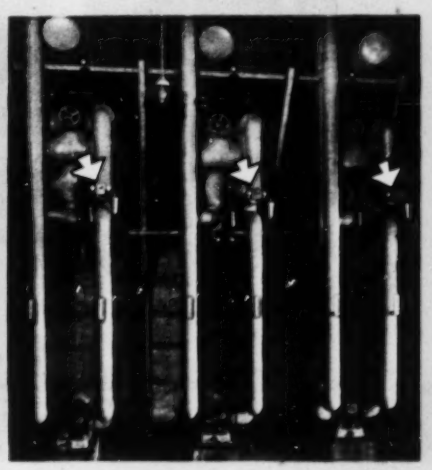
See Your Phone Book

OVER 60 YEARS OF AUTOMATIC TEMPERATURE CONTROL

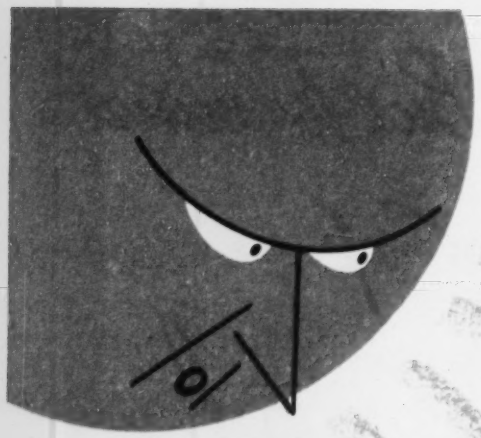
(b16)



Mr. Henry Burckert, Chief Engineer inspecting one of the two Powers Series 100 Recording-Controllers on two Centrifigul Refrigerating Compressors (610 Ton Cap.) supplying chilled water for air conditioning.



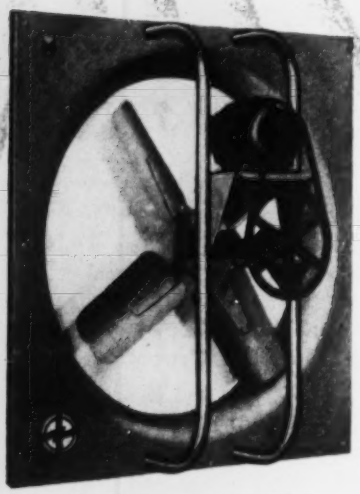
Nine Powers ACCRITEM Regulators above operate FLOWRITE diaphragm valves which control chilled water in summer and hot water in winter supplied to individual coils throughout the building.



built to beat the summer heat in industrial plants . . .

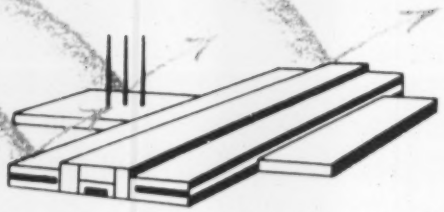
Peerless

FANS and BLOWERS



TYPE PVB INDUSTRIAL EXHAUST FAN
Belt drive unit. Fan diameters 24" to 48".

Certified Ratings — AMCA — PFMA



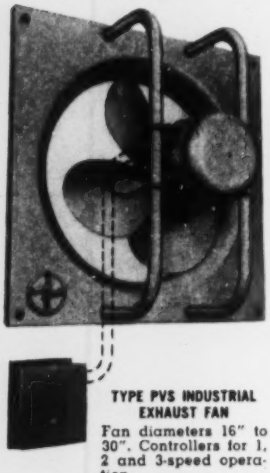
● **The Peerless line of Fans and Blowers** keeps factories, warehouses, shops or storerooms cool . . . even on hottest summer days. They are available now for immediate delivery . . . fans that will move from 4,000 to 21,000 C.F.M. . . . powered by ¼ to 1½ horsepower motors.

To be specific, Peerless PVB Exhaust Fans are ideal for use in factories and foundries and may be installed in duct installations. They are built for continuous duty . . . move dusty, dirt-laden, humid air out and cool air in.

The PVB series is rugged in construction . . . motors are ball bearing, totally enclosed. Fan shaft is supported by rigid enclosed ball bearing pillow blocks. These exceptional Peerless design features cut maintenance costs and reduce breakdowns.

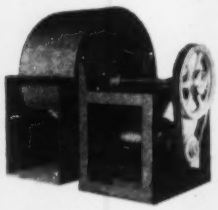
Peerless PVB Industrial Exhaust Fans are available for delivery now in all sizes. Like all Peerless products, they are fully guaranteed.

There is a Peerless Fan or Blower fitted for your needs. For full information call, write or wire the Peerless Electric Company today.

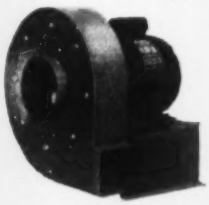


TYPE PVS INDUSTRIAL EXHAUST FAN
Fan diameters 16" to 30". Controllers for 1, 2 and 3-speed operation.

DIRECT DRIVE UTILITY BLOWERS
For boiler rooms, restaurants, washrooms, etc. Arc-welded housings constructed of 16-gauge steel. Available in all types of current characteristics to suit all requirements.



BELT DRIVE UTILITY BLOWERS
Completely assembled with adjustable motor pulley for varying speeds. Housings can be tilted when exhaust angles are required. V-belt drives are selected with conservative ratings for long service.



PRESSURE BLOWERS
For small exhaust systems where air is laden with dust or grit, and for supplying high pressure air for conveying, cooling, etc. Self-cleaning blades. Heavy-gauge, arc-welded steel housings for rigidity and long life.

"SMOOTHEST PERFORMERS ON THE MARKET"

FAN AND BLOWER DIVISION

THE PEERLESS ELECTRIC COMPANY

1409 WEST MARKET ST. · WARREN, OHIO

Peerless Electric

Guaranteed TO SHUT TIGHT*

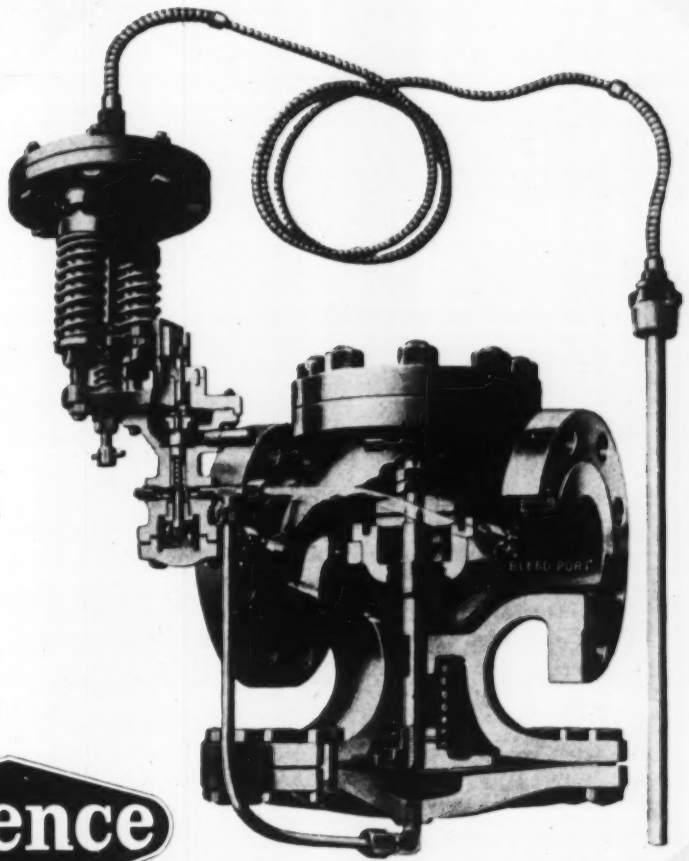
* When equipped with a SECO Metal Seat and Disc on steam service and protected by an approved Strainer, a Spence Regulator is guaranteed to shut tight when the demand for steam ceases.

Expensive steam leaks due to a lack of absolutely tight shutoff are eliminated in Spence Temperature Regulators. Here is why we can make such a guarantee:

First, our temperature regulators are of the single seat design. Seats and discs are made of durable SECO Metal. More than 20 years experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

These plus other design features explain why Spence Temperature Regulators function dependably and accurately year after year without requiring expensive repairs or special attention.

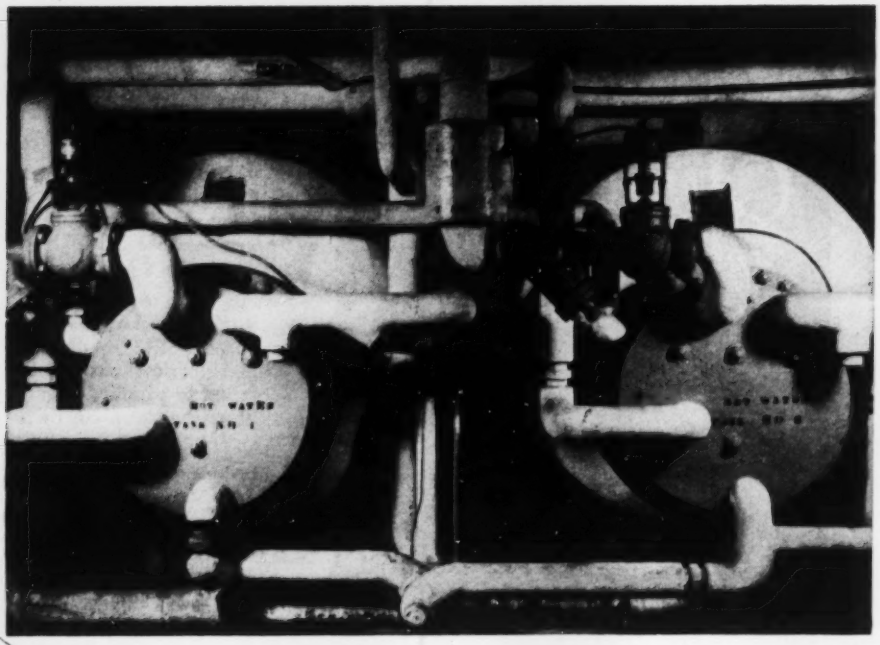
Want more facts? Write for Bulletin T50 giving full details.



SPENCE
TYPE ET150
Temperature
Regulator

Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK



performing the same operation for 22 years to save hospital costs

At the Pratt Diagnostic department of the New England Medical Center Hospital in Boston, **p-k** hot water heaters have been performing their work successfully for 22 years and amputating part of hot water cost without anesthesia.

So satisfactory has the original **p-k** installation performed that recent additional equipment was specified **p-k**. The two new heaters are copper lined to insure clean, rust free hot water as required. Each unit heats 1100 gph from 40°F to 180°F. Each has an oversize condensate coil — 650 sq. ft. — which is cooling the heating system condensate from over 212°F to less than 130°F.

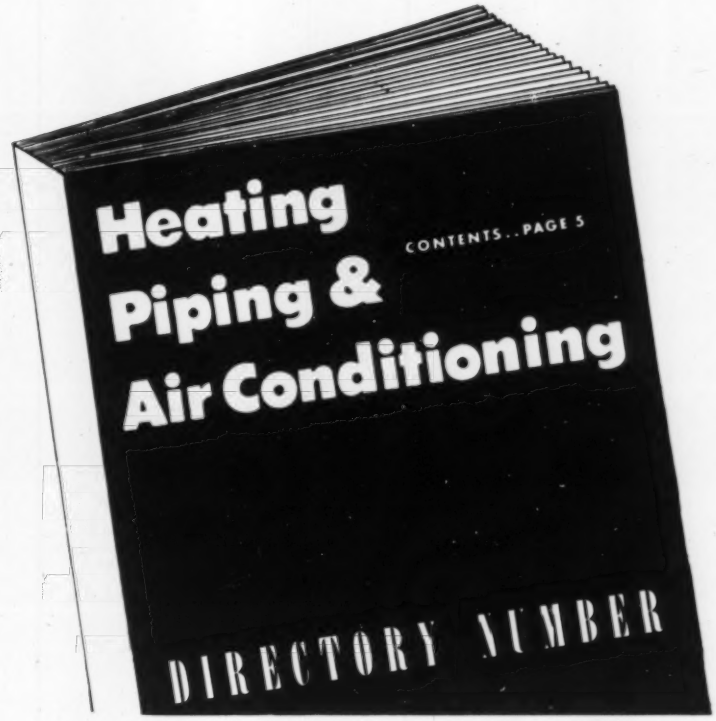
No matter what your heat exchange needs — heating or cooling — it will pay you to ask **p-k** for information now. Engineering guidance is available on call. Write now for Catalog No. 5.

the Patterson-Kelley Co., inc.

770 Burson Street, East Stroudsburg, Penn.

1953

101 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston 16 • and other principal cities



- PRODUCTS CLASSIFIED
- TRADE NAMES
- MANUFACTURERS' ADDRESSES

HERE IS YOUR SOURCE

of Complete Product Information

. . . Are You Finding It Useful?

If you are like the average subscriber,* you have near at hand—and frequently use—the January 1953 Directory Number of HPAC . . . . the field's complete reference guide to the products which engineers and contractors specify and purchase for the heating, piping and air conditioning work they handle.

Each January you get a new, up-to-date HP&AC Directory Edition. It's a part of your annual subscription to our publication.

Soon we will be starting to compile the January 1954 Directory Number.

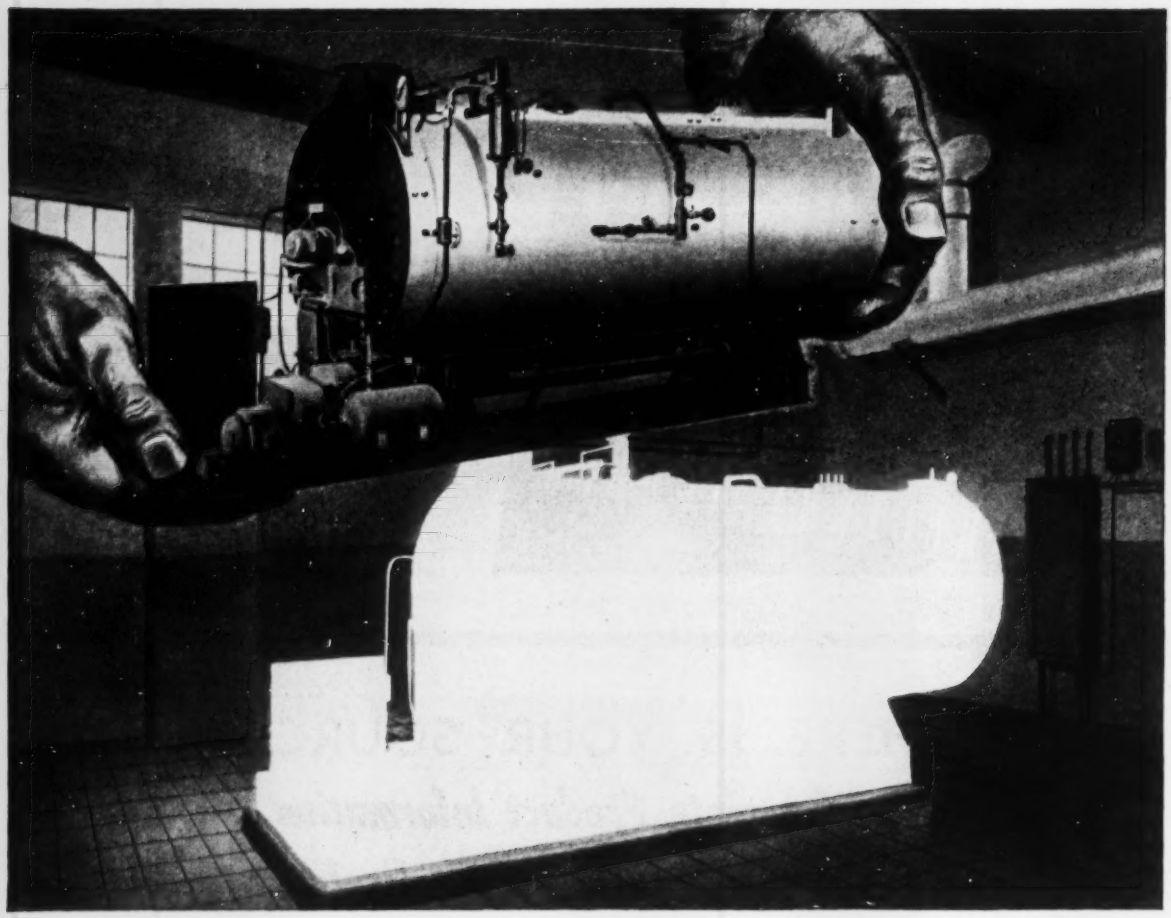
Have you any suggestions for making the 1954 edition *more* valuable? . . . . suggestions which we as publishers might adopt, or which we can pass along to the many manufacturers who co-operate with us by furnishing complete data on their products in each January Edition?

Your comments are sincerely welcomed.

Over 90% of those HP&AC subscribers, answering a recent survey, stated that they find the current (1953) Directory Edition helpful in their work.

FIRST *in Editorial . . . in Circulation . . . in Advertising*

Here's why you get more...when you buy a Cleaver-Brooks Self-Contained Boiler



...only Cleaver-Brooks can offer you the experience gained from more than 20 years of pioneering . . . and more than 12,000 individual "packaged" boiler installations

CLEAVER-BROOKS pioneering has been largely responsible for simplifying boiler buying . . . lowering costs of installation . . . delivering 80% guaranteed steam efficiency from every fuel dollar.

Boilers can be shipped as completely assembled and tested self-contained units, with auxiliaries as required. Installation involves minimum of time, construction and space. Usually connections only to steam, fuel, water lines and electrical service are needed. No special foundations are required. A short vent takes care of exhaust gases. Frequently, boilers are ready for use in a matter of *hours*, depending on availability of service lines.

Cleaver-Brooks, originators of the self-contained boiler, offers wider experience that counts in another important way. Qualified engineers help you plan steam plants tailored *exactly* for your needs. Carefully analyzed are loads, space and equipment arrangement. This not only helps you solve present steam needs, but adds flexibility for future expansion as well.

This application engineering, plus basically sound design and construction is your assurance of a full return from your boiler investment. When you specify a self-contained boiler — make sure it's a Cleaver-Brooks.

Send for Catalog AD-100 for full details on Cleaver-Brooks boilers. Available for oil, gas and combination oil/gas firing. Sizes 15 to 500 hp, 15 to 250 psi — for heating and processing.

CLEAVER-BROOKS COMPANY
Dept. H, 313 E. Keefe Ave.
Milwaukee 12, Wisconsin, U.S.A.

Cleaver-Brooks
ORIGINATORS OF THE SELF-CONTAINED BOILER
Steam Boilers • Oil and Bitumin Tank Car Heaters • Distillation Equipment
Oil and Gas Fired Conversion Burners

SERVEL gives you the SURE answer-

for AIR CONDITIONING
commercial buildings,
OLD and NEW—LARGE and SMALL

Servel 25-ton Water Chiller with no moving parts, operates continuously at peak capacity with minimum maintenance. Simple controls will modulate capacity as much as 50%, with corresponding economy.

adaptable! The Servel 25-ton absorption-type Water Chiller, because of its light floor loading and quiet, vibrationless operation, can be installed in a penthouse, on individual floors or in the basement . . . *without special foundations or floor braces.*

economical! Used with individual-room chilled water coils, this Servel system needs no expensive duct work—only simple piping. Consequently, installation is much easier—and when remodeling, costs are less.

Steam, from your most economical source, operates the unit. Even waste heat may be used. High operating efficiency is further assurance of low costs. And maintenance is minimized because there are *no moving parts* to wear or grow noisy—factory-guaranteed for five full years.

easy control! The Servel system is remarkably flexible! Individual floors or selected areas can be air-conditioned as you choose. Zone control is easily possible with separate units placed where desired, or from a central source.

Let your Servel dealer tell you more about Servel Water Chillers for *Air Conditioning, Process Cooling* and *Industrial Precooling* . . . or mail the coupon for information and engineering co-operation. No obligation.

Servel

the name to watch for great advances in

AIR CONDITIONING ✓ REFRIGERATION

MAIL NOW FOR COMPLETE DETAILS!

SERVEL, INC., Dept. HP-7, Evansville 20, Indiana

Please send me complete information on Servel equipment for ☐ Air Conditioning ☐ Process Cooling ☐ Industrial Precooling

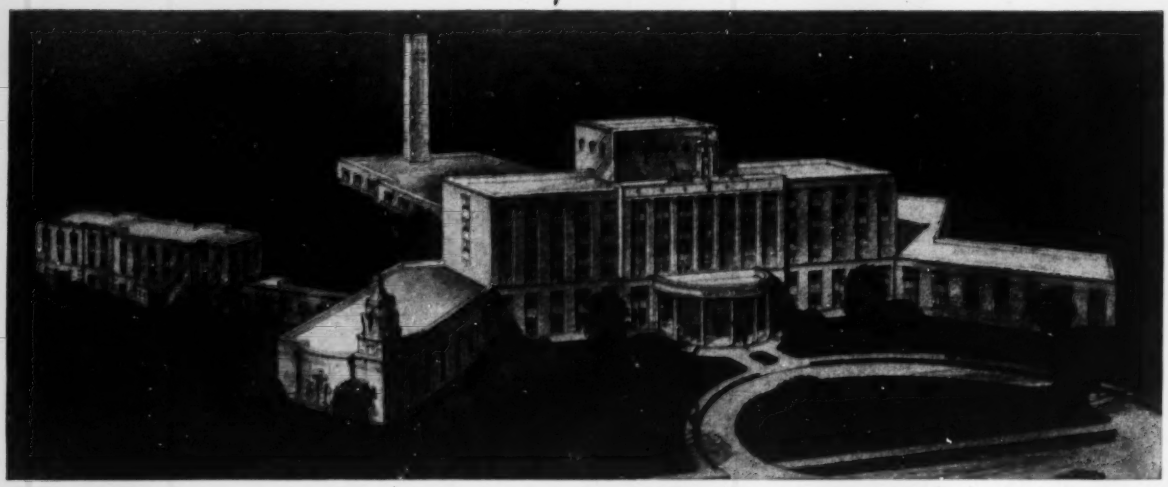
Name _____

Firm _____

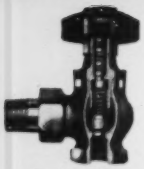
Address _____

City _____ County _____ State _____

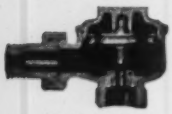
ILLINOIS ZONE CONTROL



ST. ANTHONY'S MEMORIAL HOSPITAL, Effingham, Illinois
Architect: HENRY R. SLABY, A. I. A., Milwaukee, Wisconsin
Heating Contractor: PETERSON PLUMBING AND HEATING, Centralia, Ill.



Series 48 Radiator Valve



Series G Radiator Trap

Series G Float and Thermostatic Trap

An ILLINOIS High Vacuum Heating System perfectly controlled assures maximum fuel economy, comfort and convenience in this new hospital, convent, chapel group.

Steam is supplied from a high pressure boiler plant, with pressure reduced to two or three pounds for the heating, ventilating and air conditioning.

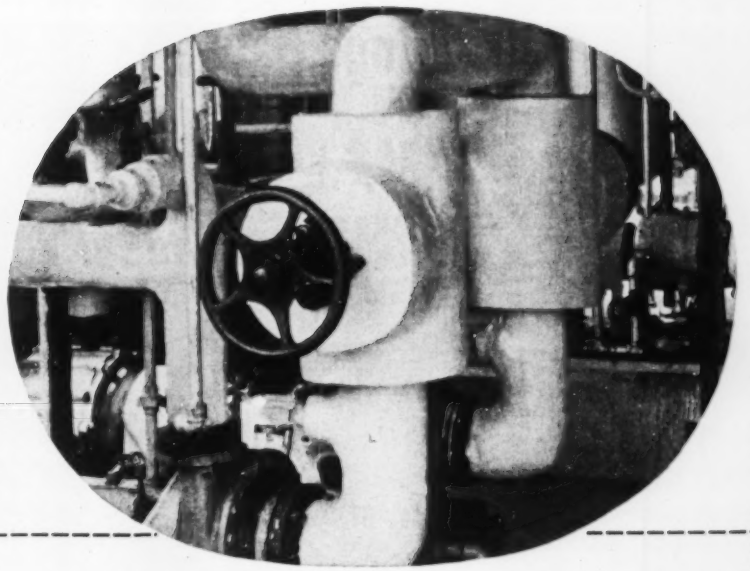
The hospital is heated with a four-zone ILLINOIS Type A Pneumatic Control System governed by electronic outdoor-indoor controllers. Operating rooms and maternity wards are heated by separate systems with individual control. The convent is equipped with a two-zone Cycling Flow Control System controlled by Type E-4 electric valves with two-stage thermostat and immersion stat.

Other ILLINOIS Heating Systems include Type C Generation Control as well as the Standard Vacuum and Vapor Systems.

Write for Bulletins

ILLINOIS ENGINEERING COMPANY
INCORPORATED 1900
RACINE AVENUE AT 21ST STREET • CHICAGO 8

Users agree that Swift's Lagging Adhesive is



Moisture and mold resistant

Swift's Lagging Adhesive resists the action of oils, fats, mold and vermin. What's more, Swift's Lagging Adhesive:

Is an excellent undercoating for paint, reduces penetration in lagging cloth . . . paint goes further.

Easy to use . . . brushes on without dragging. Dilute with water, if desired.

Safe! Won't support combustion. Is an inert resin emulsion base, free of inflammable solvents.

Saves time with a fast set . . . dries quickly to a strong, continuous film even under adverse humidity conditions.

Tops as a cement and size in applying modern insulations.

Call **SWIFT** first for **ADHESIVES**

SWIFT & COMPANY
Adhesive Products Department
Chicago 9, Illinois

This offer expires August 31, 1953

Please send me your _____ gallon introductory trial shipment of Swift's Lagging Adhesive at the quantity price, to be tested for use in our operations. We understand, if not fully satisfactory, it may be returned for credit at your expense.

Name _____

Firm Name _____

Address _____

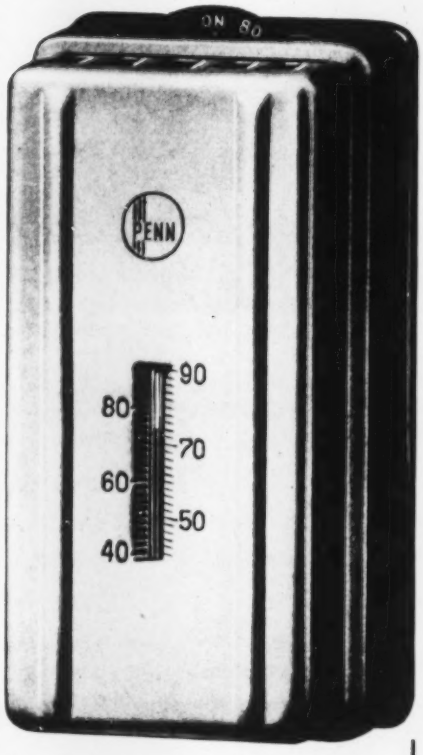
City _____ *Zone* _____ *State* _____

3 things happen when your UNIT HEATERS have PENN *individual controls!*

First, you get selective heating for each department or section of a plant depending upon its needs. Once set, the operation is automatic. PENN's famous *heat anticipation* holds temperature closely to the selected level for real heating comfort.

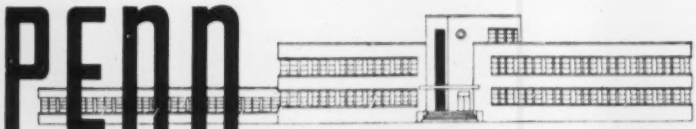
Second, during the heating season, the built-in "ON-OFF" switch featured in the PENN unit heater thermostat is a great fuel saver. A mere rotation of the dial to "OFF" position stops heat flow during idle periods . . . or to little-used areas . . . or to areas where heat can escape such as receiving or shipping rooms which may be exposed to outside temperatures for long periods.

Third, during the summer, this *same* switch permits manual control of unit heater fan for ventilation whenever desired. For continuous fan operation, merely rotate dial to "ON" position.



Learn more about this *better control* for unit heaters. Ask your manufacturer, wholesaler or write **Penn Controls, Inc., Goshen, Indiana.** Export Division: 13 E. 40th Street, New York 16, N. Y., U.S.A. In Canada: Penn Controls Limited, Toronto, Ontario.

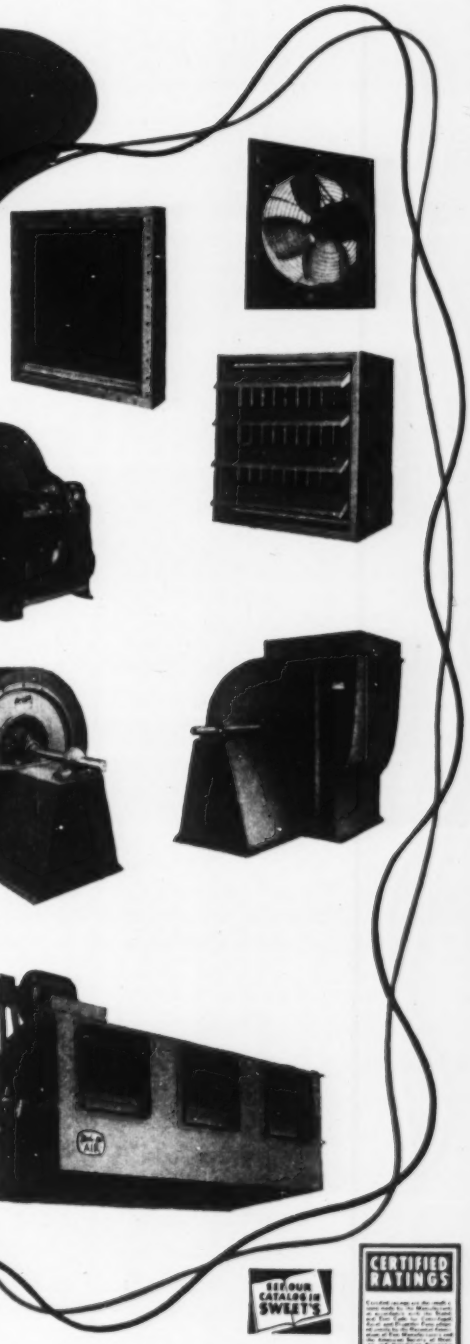
DID YOU KNOW . . . In addition to heating controls, PENN has a complete line of refrigeration and air conditioning controls for your specific needs. Included in this line are cooling thermostats, humidistats, water valves, solenoid valves, magnetic starters, temperature and pressure controls, oil protection controls for pressure-lubricated refrigeration compressors and many others. Bring your control problems to PENN . . . you'll get the correct solution.



AUTOMATIC CONTROLS

FOR HEATING, REFRIGERATION, AIR CONDITIONING, GAS APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES

nyb PROPELLER FANS



Propeller type ventilating fans deliver large volumes of air at low resistance and low current consumption. All wheels are machine balanced for smooth, vibrationless operation. Made in 2 types and 7 basic sizes to cover a wide range of industrial applications. Pressed steel panels provide rigid support and simplify installation. Totally enclosed motors mounted in heavy welded wire safety guard. Wheel diameters from 12 inch to 48 inch. Direct or belted drive. Capacities from 675 cfm to 23,500 cfm.

Penthouses for roof installation of ***nyb*** Propeller Fans can be furnished in 7 sizes. Louvers open and close automatically to protect fan against the weather. Separate louvers for wall mounting also available.

Write for Bulletins

IUHA HEAT WITH UNIT HEATERS

SEE OUR CATALOG IN SWEET'S

CERTIFIED RATINGS

All New York Blower Company products are laboratory tested, accurately rated and fully guaranteed in strict accordance with Standard Test Codes.

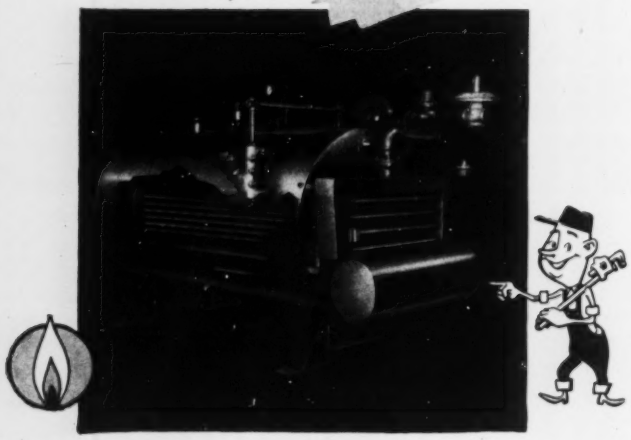
THE NEW YORK BLOWER COMPANY

SALES OFFICES • 3159 SOUTH SHIELDS AVENUE • CHICAGO 16

FACTORY, LAPORTE, INDIANA

Buy a Boiler You Can Understand

You don't need to be an Einstein or an atomic scientist to understand a Sellers Immersion Steam Boiler. The advantages of the Sellers immersion firing principle are apparent because it is based on practical engineering and common sense. Every pound of metal in a Sellers is strictly functional. Every tube and turn is designed and located for maximum efficiency and safety, for steam production at lowest cost!



IN A SELLERS:

1. **Firing tubes are completely submerged. All the heat goes directly into the water. Maximum heat transfer. No water line corrosion.**
2. **Water surface area is nearly three times that of a conventional boiler of comparable capacity.**
3. **There is no separate enclosed combustion chamber. No explosion hazard, no brick linings to replace, no carbon traps.**
4. **Expansion and contraction of firing tubes effectively combats scale.**

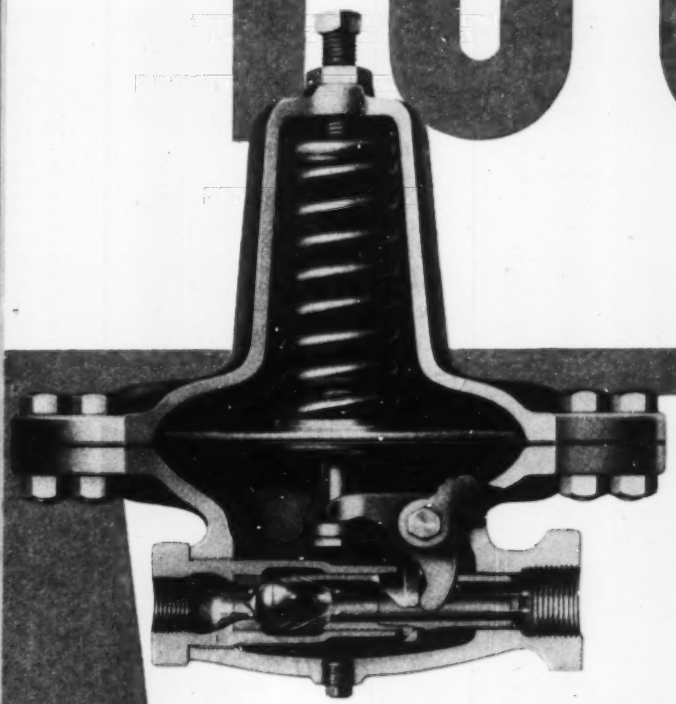
Sellers Immersion Steam Boilers are available in twelve sizes to meet all standard requirements. All are built to A.S.M.E. Power Codes. It will pay you to get the complete Sellers story. Write for bulletin No. 1206C-H5 today.

Sellers ENGINEERING CO.

4876 N. CLARK STREET CHICAGO, ILL.

Blast Heaters • Immersion Automatic Water Heaters • Combustion Units • Industrial Gas Burners
Vertical Steam Boilers • Immersion Tank Heaters • Gas Combustion Equipment

TYPE 1000 VALVE



Any product of quality should be dependable when *ordinary* products fail. Sudden pressure fluctuations, dirt, scale and viscous matter prove "fatal" to ordinary pressure reducing valves.

The CASH STANDARD TYPE 1000 VALVE however, is designed to operate with complete dependability under the most difficult and unusual circumstances. Many of these units have been in service over 10 years and have never been taken "out of the line."

Truly an *EXTRAORDINARY* achievement of quality and design excellence.

INSTALL CASH STANDARD "TYPE 1000" VALVES

CASH STANDARD **DECATUR, ILLINOIS**

A. W. CASH COMPANY

Only SEALMASTER Gives You Positive Locking Plus Easy Shaft Mounting

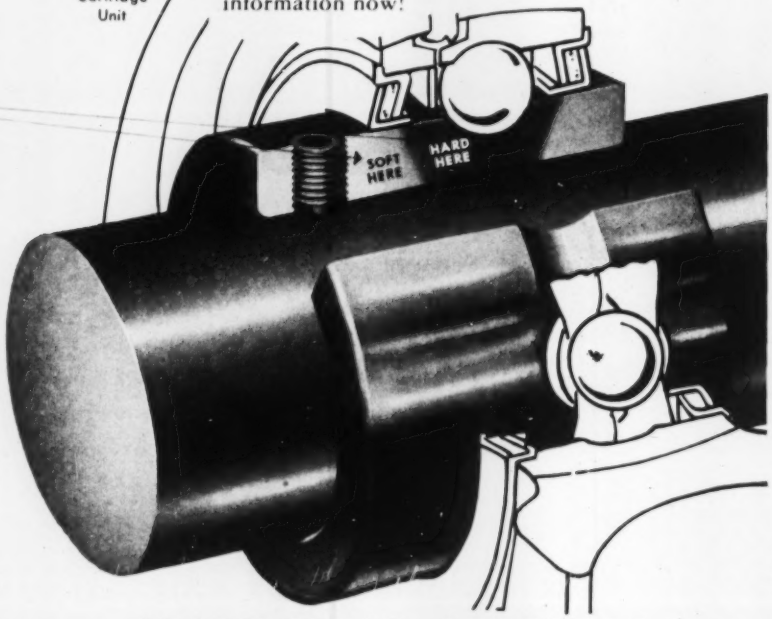
SEALMASTER BEARINGS now provide the first practical answer to positive shaft locking with easy shaft mounting. Just slip the bearing onto the shaft . . . tighten two set screws . . . that's all. This is made possible through ZONE HARDENING.*

SEALMASTER BALL BEARING UNITS

Cartridge Unit | Flange Unit | Take-Up Unit | Flange-Cartridge Unit

With Zone Hardening, the inner race of the bearing is hardened through the ball path section only. The rest of the race is left in its original, metallurgically soft state. The threads of the hardened set-screws bind firmly in this softer portion of the race and cannot work loose. This insures positive race-to-shaft locking for the life of the bearing.

In the machines you design, build or use, SEALMASTER Zone Hardening means better bearing performance, less maintenance and replacement costs. Write for full information now!



***ZONE HARDENING**

is a completely automatic heat treating process with timing controlled *to the tenth of a second.* In addition to enabling positive race-to-shaft locking, it provides a finer grained, metallurgical structure of uniform hardness in the ball path section. This gives better load carrying ability. Zone Hardening is patented . . . only SEALMASTERS have it.

SEALMASTER BEARINGS

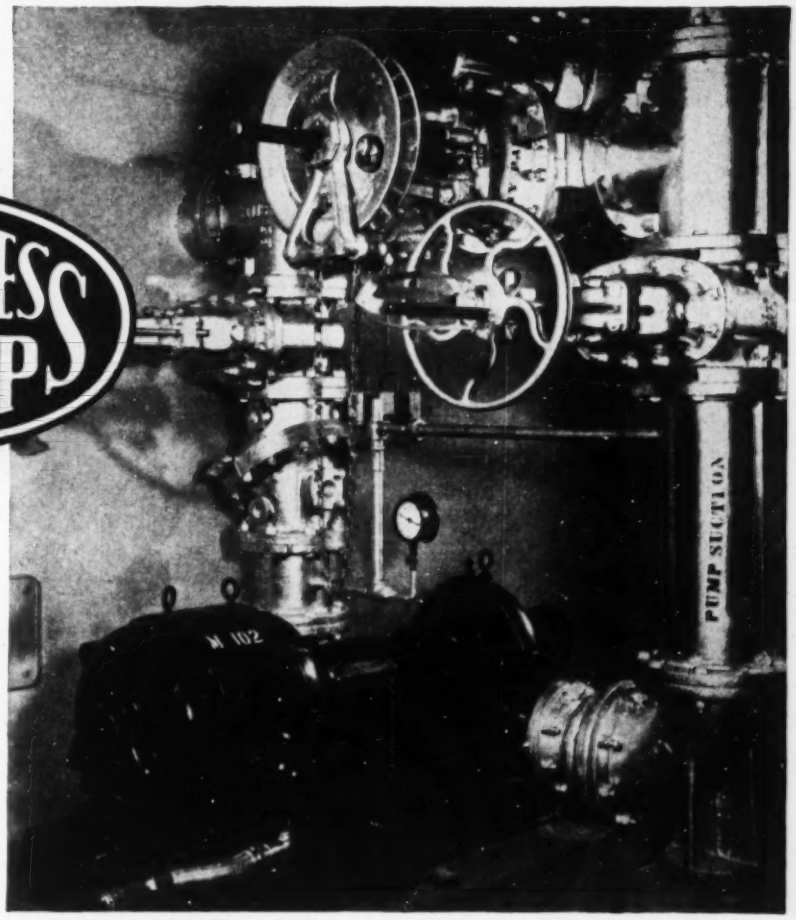
A DIVISION OF STEPHENS-ADAMSON MFG. COMPANY
47 RIDGEWAY AVENUE, AURORA, ILLINOIS

FACTORY REPRESENTATIVES AND DEALERS IN ALL PRINCIPAL CITIES

Peerless DEPENDABILITY

STOPS *Pump Troubles* BEFORE THEY START—

PEERLESS PUMPS



PEERLESS TYPE A SINGLE STAGE, SPLIT CASE HORIZONTAL PUMPS

General Characteristics

CAPACITIES: Up to 70,000 g.p.m.

HEADS: Up to 300 feet.

DRIVES: Direct-connected electric motor; belted drives; diesel, natural gas, and gasoline engine; steam turbine; combination drives.

TEMPERATURES: Handles liquids up to 300°F.

DOUBLE & SINGLE SUCTION: (Double Suction Sizes 1¼" through 48"; Single Suction Sizes 2" & 3").

BOTTOM SUCTION: (Bottom Suction Sizes 12" through 42").

BALL BEARING: Radial and thrust bearings.

THE QUALITY PEERLESS BUILDS IN *is returned to you in service*

TYPE A ***for All purpose pumping*** —Peerless Type A pumps can be used in the widest variety of general pumping services, handling water and light alkaline fluids, where no solids are in suspension.

TYPE A ***for Advanced design*** —Peerless Type A pumps are of the ball bearing type with horizontally split cases, for ease of inspection and maintenance. All are furnished with double suction impellers.

TYPE A ***for All capacities and heads*** —Peerless Type A pumps offer users greatest range in capacities, delivering up to 70,000 g.p.m. Type A characteristics permit pumping against heads up to 300 feet.

TYPE A ***for Ample safety factor*** —Oversize shafts, heavy duty ball bearings, wear rings and shaft sleeves all contribute to ample protection against wear, afford a high factor of safety in operation and assure reliable service and extended pump life.

TYPE A ***for Augmented service life*** —Type A pumps are fully tested in Peerless' modern hydraulic testing laboratory, which can duplicate the field conditions under which the pump will be used. Experienced Peerless trained engineers, located near you are at your service to see that the Type A pump matches or exceeds your requirements.

TYPE A ***for Accuracy in construction*** —Bearing seats are cast and bored integral with the case, assuring permanent alignment. Parts are machined to gage on an interchangeable part system.

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Factories: Los Angeles, Calif. and Indianapolis, Indiana.
Offices: New York; Atlanta; Chicago; St. Louis; Indianapolis; Phoenix; Fresno; Los Angeles; Tulsa; Dallas; Plainview; and Lubbock, Texas; Albuquerque, New Mexico.
Distributors in Principal Cities; Consult your Telephone Directory.

PEERLESS PUMPS fmc

••••MAIL COUPON FOR BULLETIN

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
301 West Avenue 26, Los Angeles 31, California

Please send a copy of Type A Bulletin No. B-1300.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

HPAC

you get MORE than just equipment when you specify **Marlo** *Air Conditioning*

for example...

Marlo mounts and tests motors at the factory

- ► *to save set-up time*
- ► *to assure longer, more efficient operation*

Into Marlo equipment goes special attention to those little extra details that transform a *good* piece of equipment into an *outstanding* piece of equipment.

Take motors, for example. Every Marlo motor is mounted on a pivot base easily movable in a horizontal or vertical direction. A simple adjustment establishes uniform tension on belts driving both the pump and the blower. This flexible mounting also permits easy belt replacement.

Every precaution is taken—before it leaves the factory—that the motor is

- ***Properly mounted***
- ***Checked for proper rotation***
- ***Lubricated throughout***

This concern for EXTRA details is the principal reason why IT PAYS TO SPECIFY MARLO EQUIPMENT

Marlo COIL COMPANY

Manufacturers of COOLING TOWERS • EVAPORATIVE CONDENSERS • INDUSTRIAL COOLERS • AIR CONDITIONING UNITS • MULTI-ZONE UNITS • BLAST HEATING & COOLING COILS

Saint Louis 10, Missouri

Engineered FOR ACCURATE FIT-UP

THIS TUBE-TURN Welding Return is engineered for shape, size and wall thickness to simplify piping installation. It is forged by the only process that produces a wall as uniform in thickness and true in circularity as the original seamless pipe. This assures accurate fit-up and perfect alignment . . . whether it is used as a full 180° return or cut to any odd angle.

When you specify TUBE-TURN Welding Fittings and Flanges, you are *sure* of getting the ultimate in piping simplicity, safety and permanently leakproof construction. Your nearby TUBE TURNS' Distributor is at your service!

The Leading Manufacturer of Welding Fittings and Flanges

TUBE TURNS, INC. LOUISVILLE 1, KENTUCKY

DISTRICT OFFICES: New York · Philadelphia · Pittsburgh · Chicago · Houston · Tulsa · San Francisco · Los Angeles · Denver · Atlanta

Subsidiaries: TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO • PENNSYLVANIA FORGE CORPORATION, PHILADELPHIA, PA.

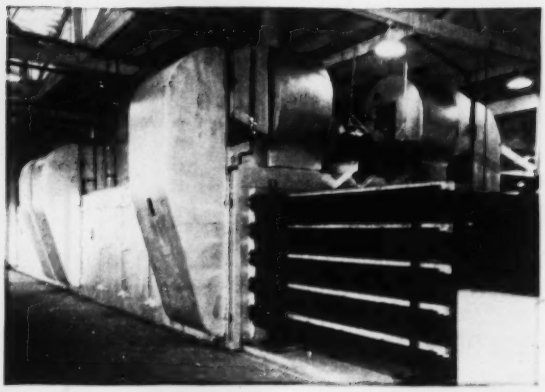
HERE'S SERVICE

TUBE TURNS' *Engineering Service*
HELPS IMPROVE A DRYER DESIGN

C. B. McLaughlin, manager of TUBE TURNS' Engineering Service Division has been working with designers and piping men in the field for years. He and his men are at your service.

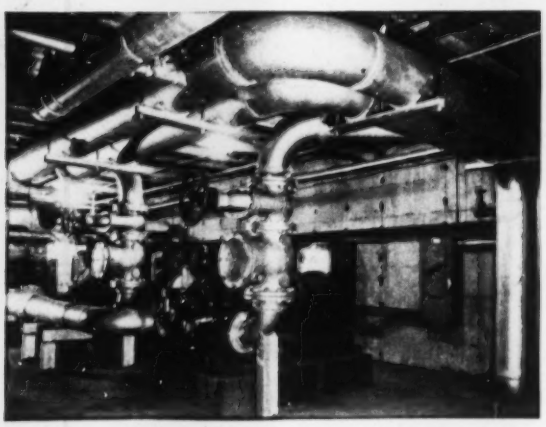
WHERE PIPING is a component of plant equipment, more and more designers are using TUBE-TURN Welding Fittings for directional changes. Results: greater design flexibility, reduced maintenance, less weight and space, improved operation. An example is the veneer dryer shown . . . a product of Coe Manufacturing Company, Painesville, Ohio. Progressive engineers of Coe, with the help of TUBE TURNS' Engineering Service Division, converted the heater from screwed connections to welded construction. Each of its banks of 1-inch pipes is joined by 180° TUBE-TURN Welding Returns. The coils carry steam at 200 psi pressure and 388°F. Joints are now permanently leakproof.

TUBE TURNS' Engineering Service is available to help in *your* piping problems.



Coe Veneer Dryer. Welded coils with TUBE-TURN Welding Returns are compact and permanently tight.

YOUR DISTRIBUTOR of TUBE-TURN Welding Fittings and Flanges can serve you promptly. He is backed up by the entire TUBE TURNS' organization.



COMPACT. Welded piping nests together . . . saves space. These condenser lines are for air conditioning system at Lazarus Department Store, Columbus, Ohio.

TUBE TURNS, INC., Dept. A-7
224 East Broadway • Louisville 1, Kentucky

Your name .....

Position .....

Company .....

Nature of business .....

Address .....

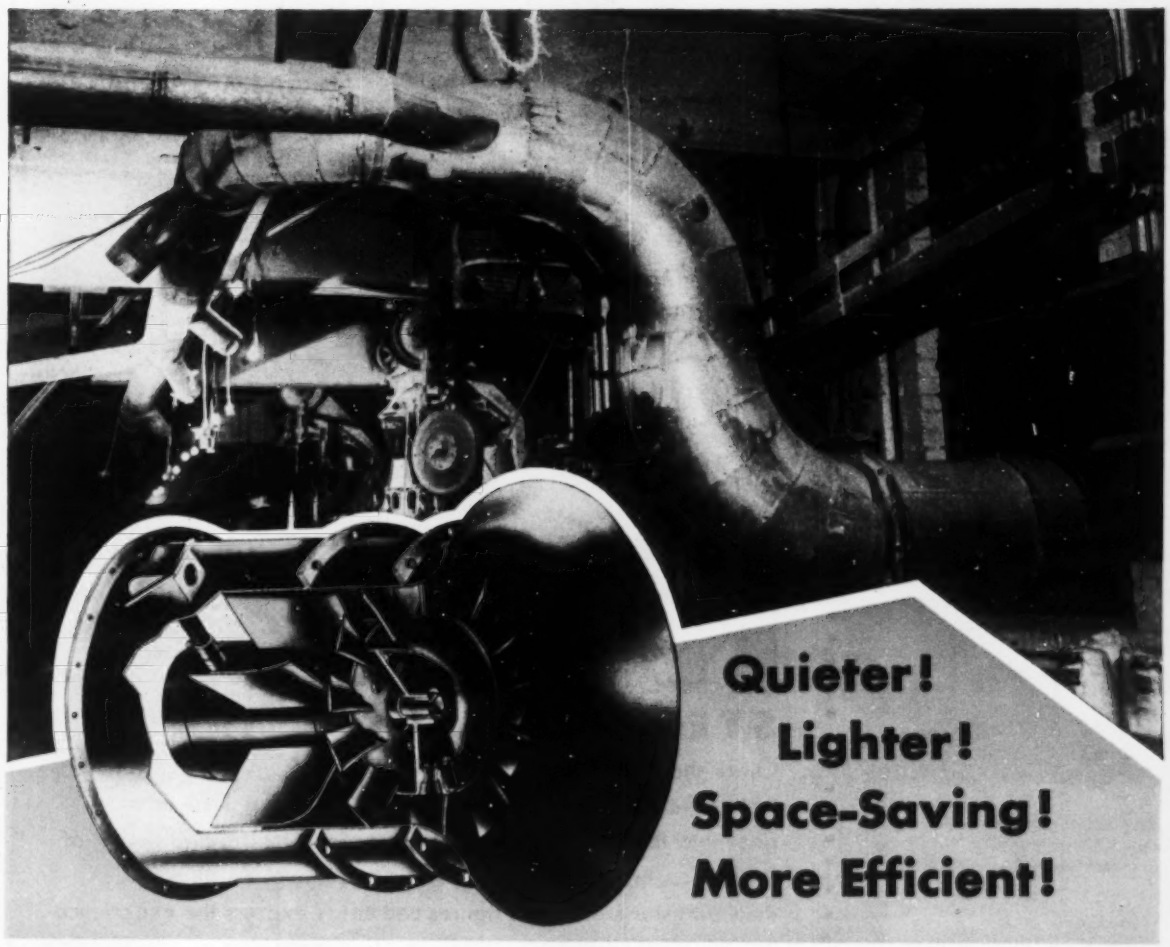
City ..... *State* .....

DISTRICT OFFICES

New York	Tulsa
Philadelphia	San Francisco
Pittsburgh	Los Angeles
Chicago	Atlanta
Houston	Denver

"tt" and "TUBE-TURN" Reg. U. S. Pat. Off.

TUBE TURNS, INC.
LOUISVILLE 1, KENTUCKY



Quieter!
Lighter!
Space-Saving!
More Efficient!

JOY AXIVANE* FANS

(SERIES 1000)

Write for Bulletin, or

Consult a Joy Engineer

The quieter operation, lighter, more compact design, lower power consumption and unmatched efficiency of JOY Axivane Fans are *real* advantages! What's more, their vaneaxial design and in-line construction permit mounting right in the air duct, making installation simple and saving greatly on time and cost. These features, plus the extreme flexibility of operating range made possible by adjustable blades—a standard feature of all JOY Fans—mean better, more dependable and lower-cost ventilation, no matter what your conditions are.

● Let JOY Axivane Fan specialists work with you for best results on your ventilation jobs.

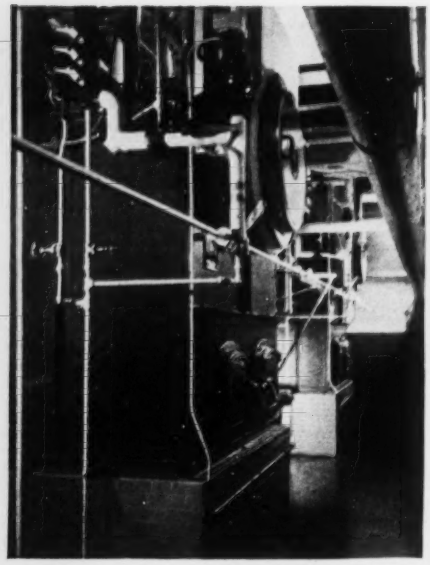
*Reg. U. S. Pat. Off.

W&D 12355

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING - PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO



MORE ENGINEERING
MORE MATERIAL
MORE EXPERIENCE

MAKE THE DIFFERENCE

KEWANEE

STEEL BOILERS

Check the specifications of any Kewanee, of *any rating*, against those of other boilers and one quickly sees how much more goes into them. Size and weight . . . width, length and height of firebox . . . heating surface . . . long gas travel . . . all tell their own story. But mere figures can never express the experience in designing and building boilers which Kewanee has accumulated over a period of 85 years. *More goes into* a Kewanee so the owner *gets more* from it.

Pictured is the boiler room of Le Bonheur Children's Hospital, Memphis, which is equipped with 3 Kewanee Hi-Test Boilers for 125 lbs. wp, gas-fired from the rear . . . one of an ever increasing number of outstanding institutional buildings for which Kewanee Boilers have been chosen to insure a dependable and economical supply of steam.

KEWANEE BOILERS

LE BONHEUR CHILDREN'S HOSPITAL
Memphis, Tenn.

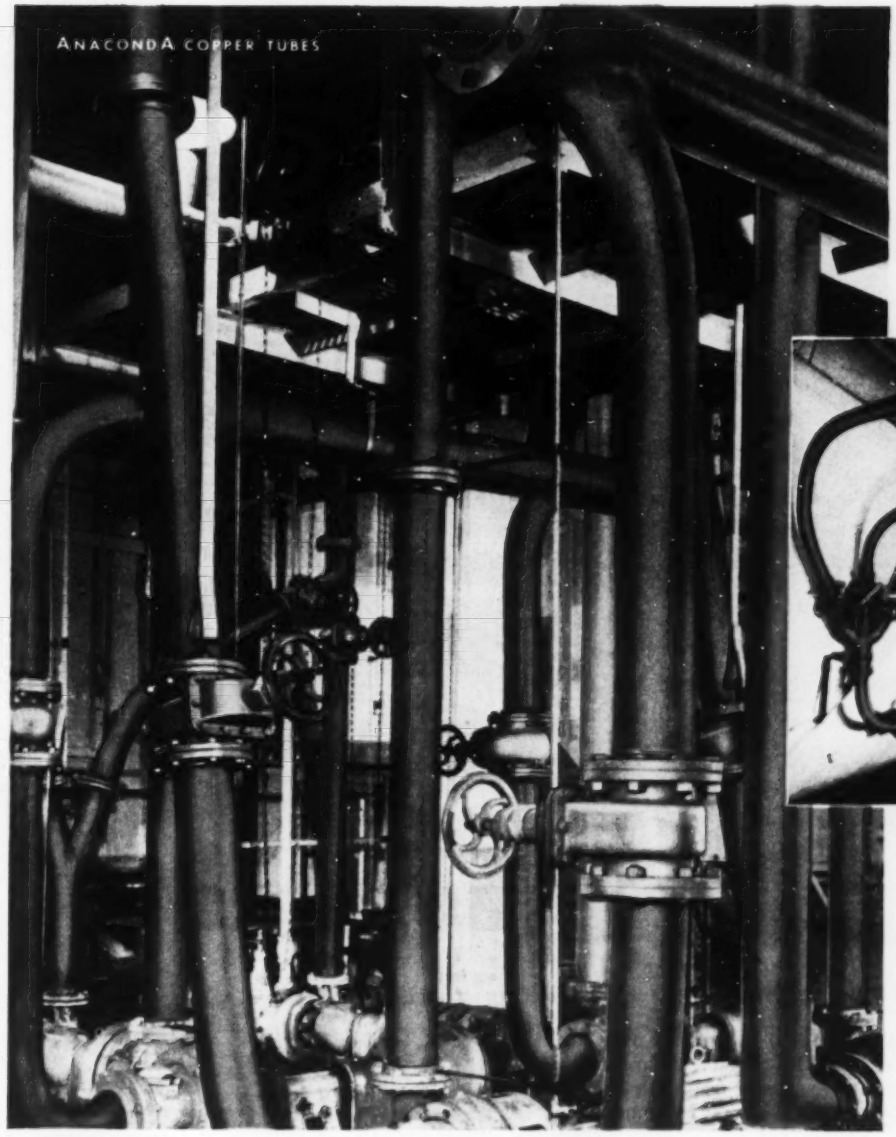
J. FRAZER SMITH AND ASSOCIATES
Architects & Engineers—Memphis, Tenn.

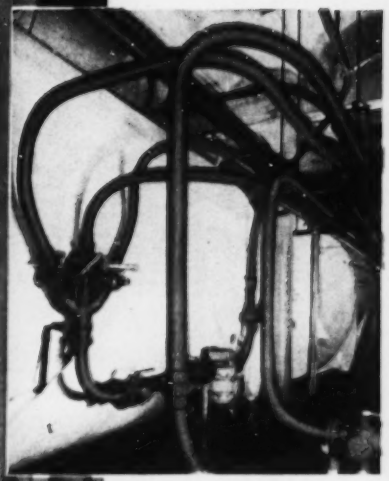
Kewanee Boilers installed by
POE PIPING & HEATING COMPANY
Greenville, S. C.

KEWANEE-ROSS CORPORATION
Division of American Radiator & Standard Sanitary Corporation
KEWANEE, ILLINOIS

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS





FINISHED BEER is fed through 2-in. ANACONDA Copper Tubes to bottling room.

PUMPING ROOM of Liebmann Breweries, Inc., Brooklyn, N. Y. Notice short bends at pumps and braze into main line (at top of picture). These are the kinds of savings you get with ANACONDA Copper Tubes.

VERSATILE COPPER:

Efficient, economical piping for brewers of Rheingold Beer

In the pictures above you'll find numerous reasons why ANACONDA *Copper Tube* pipelines are *economy* pipelines. They adapt easily to any plant layout and equipment. Long lengths of lightweight ANACONDA Copper Tubes speed assembly, too. They may be bent so you can clear beams, girders and other obstructions—without extra joints and fittings. And fewer fittings mean less flow resistance, lower pumping costs. ANACONDA Copper Tubes with solder-type fittings also permit you to make sound, economical connections. You can also dismantle and reassemble *copper* tube lines easily to meet changing plant conditions.

ANACONDA Copper Tubes are strong, rustproof and corrosion-resistant. They remain smooth and clean inside.

For reliable service on ANACONDA Copper and Copper Alloys—consult your Anaconda Distributor.

Write for free booklet, "ANACONDA Copper Tubes for Industrial Applications" to *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.* 5332

ANACONDA®

Makers of copper tubes for industrial processing, water, heating, soil, waste and vent lines; welding rods; flexible metal hose and tubing; heat exchanger tubes; bus conductors; sheet copper; refrigeration products.

Mr. Heating Contractor...

WHAT MORE COULD YOU ASK FOR THAN THIS?

- A complete line of industrial, commercial and residential oil burners
- Residential oil furnaces and boilers
- Compact units easily installed
- Highly salable equipment, with a famous name

WHICH ALL ADDS UP TO SATISFIED CUSTOMERS AND MORE PROFIT FOR YOU

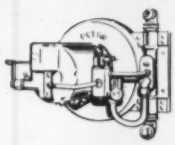
Petro OIL BURNERS

Mr. Heating Contractor, we can make your job easier and more profitable.

Petro has been building oil burners for over 50 years. The Petro line of oil firing equipment is outstanding. The Petro name is known and respected wherever oil burners and oil equipment is used. Petro dependability is traditional. The product has public acceptance.

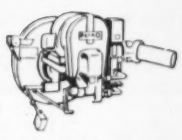
Petro units are efficient fuel savers. They are simple and dependable in operation, require a minimum amount of service, and are a profitable line to sell.

For illustrated literature and full information just write, Petro, 3188 W. 106th St., Cleveland 11, Ohio. In Canada, write 2231 Bloor St., Toronto, Ont



Industrial Oil Burners

Rotary type. Burn low-cost heavy fuel oil with complete reliability. Models for every industrial need. Capacities up to 200 gallons per hour.

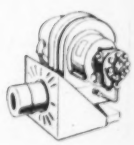


Combination Oil-Gas Burners

This commercial-industrial burner is the answer to seasonal fuel shortages. Makes possible advantages in economical fuel buying.

Residential Furnaces and Boilers

Made in popular sizes to fit the heating needs of homes of from 4 to 10 rooms. Extremely compact and attractive. Real fuel savers.



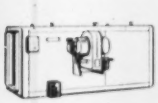
Conversion Units

Efficient, trouble-free oil burners for home and commercial use. Capacities up to 20 gallons per hour.

Industrial, Commercial, Residential oil burners for every need

PETRO

50 YEARS OF LEADERSHIP IN AUTOMATIC HEATING AND POWER EQUIPMENT



Horizontal Furnace

Hang it or hide it—this winter air conditioner fits anywhere. Available in 5 models from 80,000 to 180,000 Btu's (output at bonnet).

see our catalog in Sweet's ARCHITECTURAL FILE or write for copy

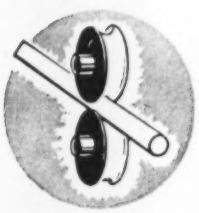
WHEN THE JOB GETS HOT...

Call your Republic Pipe Distributor

● Whether the job has to get done in hours . . . or days . . . your Republic Steel Pipe Distributor is all set to come up with whatever you need.

He has piping in the sizes and lengths you need. He has fittings, valves, fixtures, controls, and tools . . . all items for the complete job. And he can deliver them in a hurry. Just a phone call from you starts your order on its way. It's gathered from the Republic Pipe Distributor's stock room . . . not yours. You save capital investment. You save floor space. His stock room becomes yours.

It will pay you to get acquainted with your Republic Steel Pipe Distributor and the high-quality materials he stocks. He's as close as your phone.



Easy to bend, thread and close coil
Easy to weld by all methods
Uniformly ductile
Uniformly strong
Uniformly clean and scale-free
Uniform wall thickness, diameter, concentricity
Economical uniform lengths, extra long lengths

REPUBLIC STEEL

Republic STEEL PIPE

The When, Where, Why and How of Silver Alloy Brazing—

If you're in any way interested in metal joining, you'll find a lot of useful information and data on the subject in the free printed matter below. Copies of one or all are yours for the asking. Write for them today.

BULLETIN 20

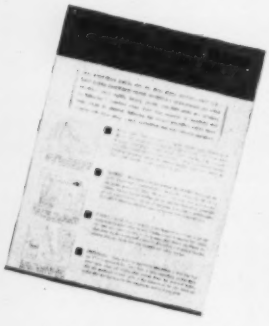
This 24-page bulletin is a "must" for every design and production engineer. It gives full details about EASY-FLO and SIL-FOS—what the alloys are—what they do—how to use them—also a lot of valuable information on joint design, heating methods and fast production procedures. You'll find plenty of meat in the illustrations, too.

BULLETIN 17

This bulletin gives complete instructions for brazing fittings to pipe and tubing with EASY-FLO and SIL-FOS. It tells—how to cut and fit pipe and tubing—how to clean and flux surfaces to be joined—how to support assemblies—how to heat—how to clean after brazing. It covers the making of vertical up, vertical down and horizontal joints.

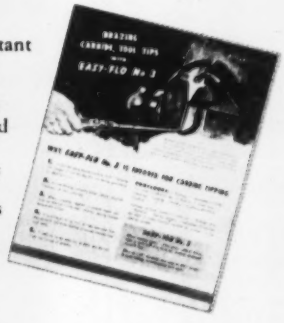
TORCH BRAZING INSTRUCTIONS

This bulletin gives full instructions for EASY-FLO and SIL-FOS alloy brazing with gas torches—including fit of joint—cleaning—fluxing—assembling—heating—applying the alloy—flux removal after brazing. Ask for the Torch Brazing Instruction Bulletin.



BULLETIN 11-A

This bulletin covers an important item in metal working shops today—the mounting of cemented carbide tool tips with EASY-FLO No. 3 on lathe and milling cutters and other carbide tipped tools and parts. It explains why EASY-FLO No. 3 is recommended for this work by leading carbide tip manufacturers and covers the procedure step-by-step for various heating methods.



BULLETIN 14

This bulletin covers the repair of broken broaches, drills, taps, band saws, circular saws, form cutters and milling cutters of all kinds with EASY-FLO. It explains how, with a few cents' worth of EASY-FLO, valuable tools can be put back in service in a jiffy at a fraction of the cost of replacement.

TECHNICAL BULLETINS

These bulletins are published periodically. They contain factual technical data and new information about low-temperature silver alloy brazing as uncovered through the Research that is carried on continually in our laboratories. If you would like to receive these bulletins as published, write and ask us to add your name to the Technical Bulletin mailing list.

HANDY & HARMAN · FOUNDED 1867 · QUALITY · SERVICE · ORIGINATORS OF EASY-FLO & SIL-FOS

HANDY & HARMAN

General Offices: 82 Fulton St., New York 38, N. Y.

DISTRIBUTORS IN PRINCIPAL CITIES

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BRIDGEPORT, CONN.
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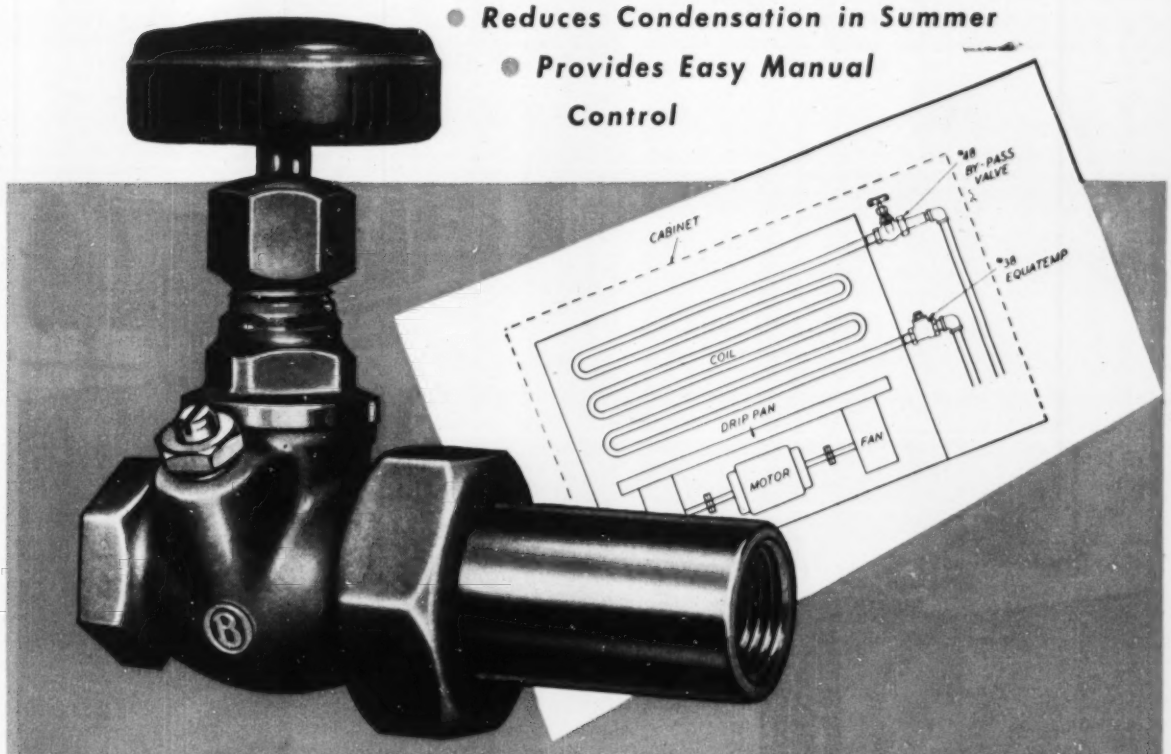
TORONTO, CANADA
MONTREAL, CANADA

New O-B No.48 By-Pass Valve

- For Air Conditioning Units
- Prevents Freezing in Winter
- Reduces Condensation in Summer
- Provides Easy Manual Control



This new valve is designed especially for use on room units of year-around air conditioning systems. Basically, it's a sturdy globe valve for manual control of room temperature. But probably the most important single feature is the by-pass. It remains open in winter, even with the valve closed, to allow enough circulation to prevent freezing. In summer the by-pass is closed so that no cold water can stand in the unit when it is shut off. This eliminates the danger of excess condensation.

Usual procedure is to install the No. 48 in combination with O-B Equatemp as shown in the line drawing. It can also be used separately from Equatemp®, the valve that both balances and shuts off. The combination of Equatemp and No. 48 valves offers complete temperature control, positive on-and-off regulation, balancing, and provisions for venting, draining and temperature readings. A union nut and tail piece comes with the No. 48 Valve. Send in the coupon below for a folder giving complete information.

Ohio Brass

MANSFIELD · OHIO

BRONZE GLOBES - GATES - CHECKS - ANGLES
FOR INDUSTRIAL, DOMESTIC SERVICE

Ohio Brass Company
Mansfield, Ohio

Please send me the new Equatemp and No. 48 Valve folder, 1271-V.

Name .....

Company .....

Street .....

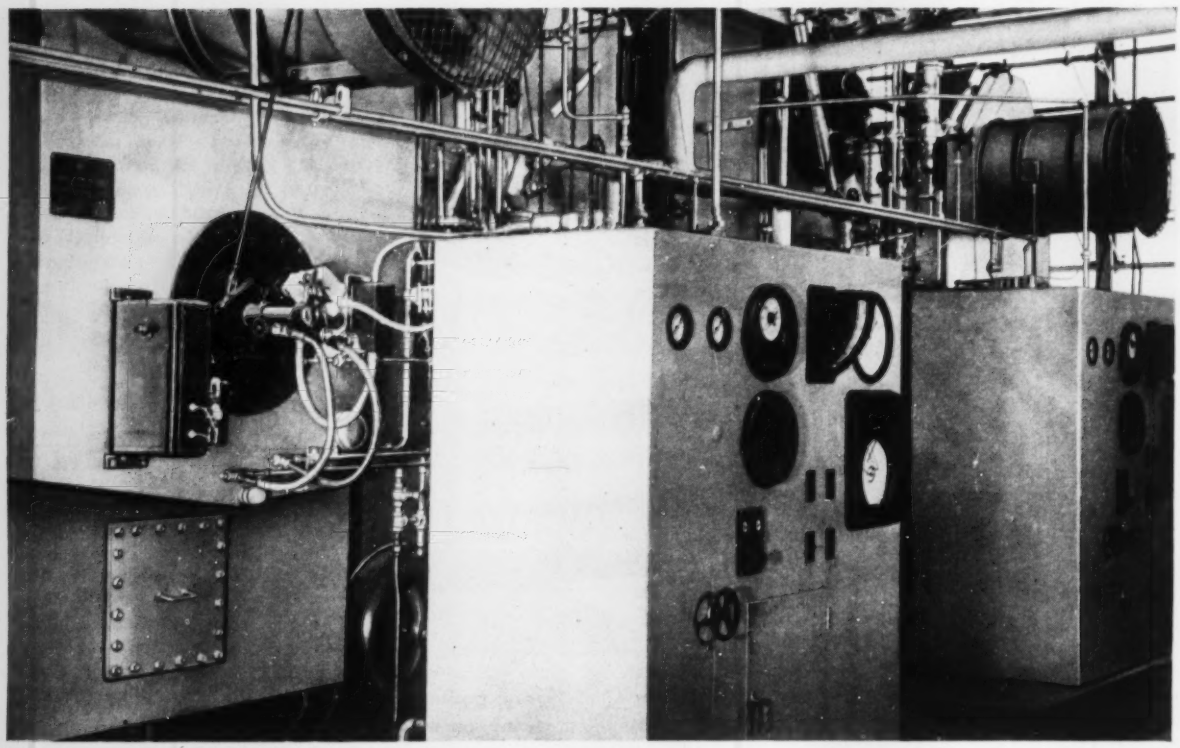
City ..... State .....

4577-V

keeping steam cheap . . .

Rx for HOSPITALS

with the B&W Type FM Boiler



These two Type FM, B&W Integral-Furnace Boilers supply steam for all heating, cooking, and laundry requirements at a large midwestern hospital.

COST-SAVING FEATURES

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space
- Safe, Automatic Operation

Among the many enthusiastic users of the shop-assembled B&W Integral-Furnace Boiler, Type FM, hospitals have found it uniquely suitable to meet their varied steam requirements. Typical of the FM Boilers now serving hospitals in various parts of the country is this dual-unit installation, which is supplying low-cost steam for all heating, laundry, and cooking requirements at a midwestern institution.

Easy to install, this compact B&W steam generator is delivered complete with firing equipment and controls . . . is ready to skid or lift into position, hook-up, and place in operation. Push-button starting and stopping and automatic handling of load variations simplify operation . . . make the Type FM Boiler ideal for small to medium-sized installations where operators have additional duties. Even for some larger installations it has been found practical and more economical to have a multiple-unit, Type FM installation rather than one or more large boilers requiring complete field erection and close operating supervision.

Available in standard sizes for loads ranging between 2900 and 28,000 lb of steam per hr at pressures to 235 psi, this efficient B&W unit is already enjoying wide popularity with users in a broad range of industrial, commercial, institutional, and other classifications . . . is in service or on order for a total steam capacity approaching 7,000,000 lb per hr.

For a detailed illustrated description of how you can benefit from the cost-saving features of the B&W Type FM Boiler, write for Bulletin G-76A. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd St., New York 17, N. Y.

BABCOCK & WILCOX
BOILER DIVISION

G-611

THE EDITOR'S PAGES

WE'VE OFTEN WISHED somebody would start a campaign to "co-ordinate" meetings and technical sessions so that those on similar subjects or appealing to similar interests wouldn't be scheduled for the same time. It seems to us that there are several disadvantages when meetings on the same or closely related subjects overlap or are held concurrently. For one thing, attendance is bound to suffer, for those interested in both must make a choice between the two.

Average Office Worker Needs 1 3 Ton for A.C.

AIR CONDITIONING the average office is like giving every person in it a third of a ton of ice each day to keep him comfortable, according to E. I. du Pont de Nemours & Co.

That's what one New York consulting engineer estimates as the normal requirement for a typical office building air conditioning system. He arrived at his figures by allowing 110 sq ft of floor area per person and estimating the average amount of body heat generated by an office worker, plus the amount of heat given off by a lighting load of 2.5 watts per sq ft of floor space.

Cooling is only one of the benefits of such air conditioning systems. Studies have shown that they increase the productive output of workers and help reduce absenteeism. Practically all office air conditioning systems filter the air to remove dust, dirt, smoke, soot, and pollen, and dehumidify it.

L. C. McKesson Heads New ARI

L. C. MCKESSON, of the Ansul Chemical Co., was elected president of the Air-Conditioning and Refrigeration Institute at its first board of directors meeting. A. J. De Fino, of Fedders-Quigan Corp., was named vice president, and James Emmett, James P. Marsh Corp., was elected treasurer.

George S. Jones, Jr., formerly vice president in charge of sales, Servel, Inc., has been named managing director of the ARI. The headquarters address is 1346 Connecticut Ave., N.W., Washington 6, D.C.

Following the meeting, Mr. McKesson said, "We are extremely happy to have accomplished the consolidation of the REMA and the ACRMA. It brings together over 150 of the leading manufacturers of refrigeration and air conditioning equipment and gives to the industry a united front which we believe will result in greater service to all of our members and in greater and more far-reaching activities."

Sees the Fully Air Conditioned Life

AVERAGE WORKER "John Smith" will sleep, eat, work, commute and play in an air conditioned atmosphere within the next decade, according to D. C. Minard, president of The Trane Co.

Air conditioning is shifting rapidly from a luxury to a necessity in new residential and industrial construction in addition to commercial and amusement building, Mr. Minard told 78 key field sales engineers who attended an intensive four-day "refresher course" in the latest air conditioning and refrigeration engineering developments.

New product developments, production engineering economies, rising public demand and increasing competition are four important factors working to broaden the market for air conditioning, Mr. Minard said. New products introduced since January 1950 will account for more than one-third of Trane's sales during 1953, he said.

Complete year 'round air conditioning of new office buildings, shopping centers and precision manufacturing plants is resulting in competitive pressures on the owners of older structures, Mr. Minard reported. Employers are finding that production efficiency is up and labor turnover down in air conditioned offices and factories. As a result, there is a higher proportion of inquiries and requests for quotations on equipment for air conditioning existing buildings.

New orders for all the company's products are up 33 percent compared with a year ago, while new orders for all refrigeration and air conditioning products have increased at the highest rate in the company's history, Mr. Minard said.

Engineer Reads to Shut-Ins Via Radio

H. J. COUCH has long wanted to do something for blind people and shut-ins, for his mother is blind. It occurred to him that reading aloud via radio to all who wanted to listen would be an appreciated service — so that's what he's doing from 10:15 to 10:30 a.m. every day, Monday through Friday, over WFJL, an FM station in Chicago.

He doesn't believe in condensing a good book, so he starts at the front and goes right on through. The one he's reading now will take some 80 periods to finish.

Mr. Couch is a sales engineer with American Air Filter Co. The broadcasts are put on tape as time becomes available week-ends and evenings.

Modern Merchandising Requires Air Conditioning

PARTICLES OF RUBBER tires, soot, pollen and harmful bacteria are four of the eight principal elements polluting the air in our large cities, J. F.

Front Cover Photo

STEAM GENERATOR developed at Argonne National Laboratory for use with the experimental breeder reactor. The new generator differs greatly in appearance and in some regards in construction from conventional steam-producing systems. In addition to assuring high steam generating efficiency, it contains unique design features, which prevent mixing of the reactor's alkali metal coolant and water or steam which, in contact, react violently. Steam from this generator is conducted to a superheater from which it emerges at a temperature of 550 F and at a pressure of 400 lb per sq in. It is then fed to a turbogenerator where it is used to produce the 170 kw of electricity which ordinarily is required to meet all of the power demands of the reactor and the building in which it is housed.

Knoff, Chrysler Airtemp vice president, told retail merchandisers attending the fourth store modernization and maintenance show in New York. Cinders and lime deposits, sand and grit also cause unfavorable shopping and working conditions during the summer months in the majority of the nation's retail stores, he said.

Air conditioned stores enjoy better customer relations, cleaner merchandise, less need for repainting and cleaning of fixtures and drapes, and more comfortable conditions even during the trying holiday shopping season, he said, and "even a more cheerful breed of sales people work in air conditioned stores."

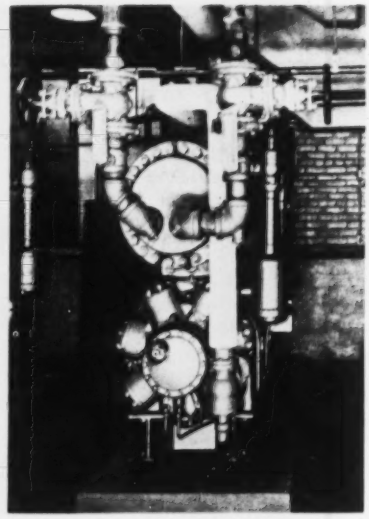
"Air conditioning no longer is a considered part of store modernization," he stated, " — it's either a reality or a must." He said a large department store in a southern city maintains a "bank" of packaged air conditioners on rollers with flexible connections. They are used while major store renovations — requiring the disconnection of part of the central system duct work — are completed.

Engineering Behind the Iron Curtain

AN INTERESTING — and appalling — article by P. A. Abetti in the May issue of the General Electric Review shows how engineering, "often reputed to be entirely separated from politics, is being drawn more and more into the struggle by the rulers of the Red countries."

Under the title, Engineering Behind the Iron Curtain, Mr. Abetti quotes extensively from Russian and satellite technical journals in the field of electrical engineering. Even the highly technical articles from which he quotes are loaded with political propaganda and wild attacks against the free world.

One of the weird quotations is from a Yugoslavian technical book on the transformation and transmission of energy. The book says there are two types of transformers, one of them being "the capitalistic robber-transformer" and the other the new socialistic transformer. According to the book, the losses are higher in the capitalistic transformer because the capitalistic electric utilities want the cheapest transformer so they can pass the cost of the high losses on to the consumer.



CONDENSING WATER used by the two 14 cylinder, 75 hp compressors is then pumped to the washing machines for further use

New Hospital Has Air Conditioned Laundry

AN AIR CONDITIONED laundry serves the 1500 bed Grace-New Haven (Conn.) community hospital. Located in the basement of the hospital's new 340 bed memorial unit, the laundry requires 150 tons of refrigeration from two 75 hp radial compressing units.

The nine story memorial unit was opened early this year. It was designed by architect Douglas Orr, and engineered by Hubbard, Lawless and Blakely. Air conditioning and special refrigeration was installed by Ace Sales and Service.

The city water used for condensing is heated to about 100 deg., then used in the laundry's washing machines. [Photo courtesy Airtemp Div., Chrysler Corp.]

IBR Okays Public Relations Program

ESTABLISHMENT OF a public relations department by the Institute of Boiler and Radiator Manufacturers and development of a broader sales promotion program were authorized at the IBR's 38th annual meeting. Attended by 110 members, associate members and international members, it was the largest in the institute's history.

R. E. Ferry, IBR general manager, termed the public relations department "the most important step the hot water and steam heating industry has taken since the IBR research program was started."

Robert S. Waters, chairman of the board, National Radiator Co., was elected IBR chairman, and H. F. Randolph, president, International Heater Co., was named vice chairman.

With commercial construction strong and with new residential construction expected to reach 1 million units, general optimism regarding 1953 sales prospects was expressed at the meeting.

Warren Harris, research professor, University of Illinois, summarized the various studies for the hot water and steam heating industry carried on at Urbana.

Forced convectors for heating and cooling have been installed in the research residence, with a 2 ton water chiller. The same piping will be used for heating and cooling. The cooling performance will be evaluated this summer, while a study of the heating efficiency will be carried on next winter.

Developing Advanced Heating Course

A TOTAL OF 6900 students have attended the IBR School of Modern Heating since it was started in April 1950. Average attendance has been 54, although the average for 1953 is 61 students.

Arthur L. Wales, field training director, has traveled 250,000 miles.

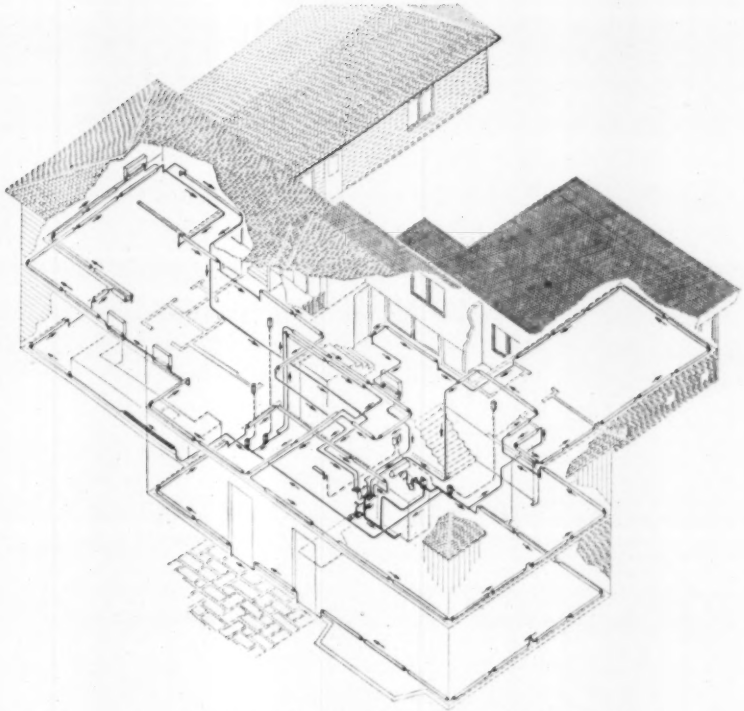
The field training committee has voted that material be developed for an advanced course to cover larger commercial structures such as motels, garages, and small apartment buildings larger than one-family residences. The proposed advance course is not intended "to invade the field of the heating engineer", but to "provide information to the average heating contractor who is called on to design systems for these types of buildings".

"Check Your Oil, Air Condition Your Car?"

"IT'S A NEW free service! Let us air condition your car here," advertises a service station in Houston.

Automobiles are given a free "shot" of conditioned air while they are being serviced. The 3 ton portable conditioner is said to be able to lower the car's temperature 20 deg in two minutes.

"...like a balmy night in June regardless of outdoor weather"



Heating plan for the Hinman home. Webster CF-2 Unit provides master control. Duplex clock thermostats provide overheat limit control for each of three zones, as follows: (1) Living room and dining room. Also includes one bedroom and bath. (2) Kitchen wing and servants' rooms. (3) Bedrooms on the second floor. Heating installation made by Seaman & Muller, Port Washington, Long Island.

Installation with Tru-Perimeter Forced Hot Water Baseboard Heating . . . 5 Circuits . . . 3 Zones . . . Outdoor Thermostat Control

A cold wind whistling in off Long Island Sound with gusts up to 60 miles an hour . . . and yet the Hinman home is warm and comfortable. George R. Hinman, president of Pioneer Scientific Corp., says:

"In 1950 when my Architect, Julius Gregory, showed me the sketches for our new house, I was struck by the large amount of glass. This and the exposed location made me think of Webster Baseboard Heating.

"Now we have been through two complete heating seasons. Temperatures everywhere in the house are like a balmy night in June, regardless of outdoor weather."

For a heating system that will match the truly fine home, consider Webster Tru-Perimeter Heating. Your Webster Representative will give you full details. Or write us.

Address Dept. HP-7

WARREN WEBSTER & COMPANY
Camden 5, N.J. Representatives in Principal U.S. Cities
In Canada, Darling Brothers, Limited, Montreal

Webster
TRU-PERIMETER FORCED HOT WATER
BASEBOARD HEATING

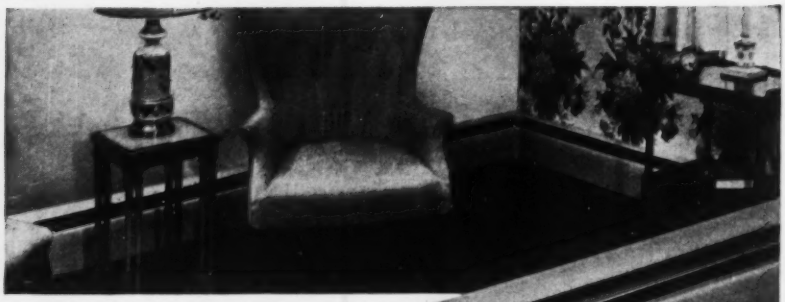
The master bedroom with glass on three sides is comfortable at all times – with mild heat in mild weather, full heat when the outdoor temperature falls or high winds blow.

The home of George R. Hinman, with its commanding view of Long Island Sound, presented a heating challenge because of its exposed location and wide expanse of glass. Mr. Hinman says: "I asked my architect about Webster Baseboard Heating and we agreed it was the logical solution. How right we were!" Julius Gregory, A.I.A., was the architect. Wesley Copp, of Sands Point, was the builder.

Designed primarily for

COMFORT

with an Intelligent Artistry...



NESBITT Baseboard Radiation

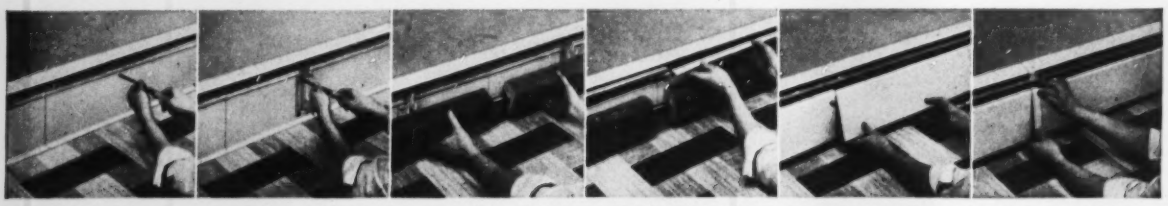
EASY TO INSTALL

PERIMETER or baseboard radiation is not a new idea . . . but Nesbitt's approach to it is. From the vantage of long experience in the field of thermal comfort, Nesbitt set out to perfect the best possible floorline convector-radiator and then to master the matter of appearance through intelligent artistry. The result is an uninhibited product—Nesbitt Baseboard Radiation—with an adequate capacity in the fin-and-tube element (4 sq. ft. per lin. ft.) to heat the average room with only one wall length—in a streamlined enclosure that fits agreeably in any decor and appeals to the modern homemaker.

Assembled, packaged lightweight units of standard lengths are available from wholesalers, with accessories and dampers as required. Ingenious helps for easy installation, including mated tube ends for jointing without fittings, save today's most expensive commodity—time. Designers and contractors who are cost-conscious, but whose better judgment dictates "wet heat," may now find their happy answer in Nesbitt Baseboard.—*Get Publication 272.*

—and to save you money

MADE BY JOHN J. NESBITT INC., PHILA. 36, PA.—SOLD EXCLUSIVELY THROUGH PLUMBING AND HEATING WHOLESALERS



1 Fasten enclosure-back to wall with screws or nails. **2** Mount the support brackets at indicated intervals. **3** Hang the assembled heating element on brackets. **4** Insert louvre blade between slots in support brackets. **5** Hang front panel on brackets, push to lock in place. **6** Attach joint trim over intersections for finishing touch.

"OPEN FOR DISCUSSION"

WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

R. S. FARR —

"I Have Basic Objections To Air Filter Code"

WHILE WE ARE A member of the Air Filter Institute, we definitely do not concur with the new AFI test method for air filters described in the June HPAC. Our basic objection to this as a test code for the air filter industry is that it does not quantitatively present filter performance results on known particle sizes of dirt.

This test, while it is intended only for panel and strainer filters, does not give the prospective user any method of predicting what the filter will do for his particular condition — assuming, of course, the prospective user determines what his dust problems are. It merely is a comparative test method on impingement and strainer type filters on one particular synthetic dust.

It is our feeling that any test code should allow the evaluation of filters on dusts of known particle sizes and specific gravity. Test information of this type not only shows the limitations of panel and impingement type filters but also shows their relative position with respect to the other types of cleaning devices.

Certainly, the proposed code does not allow the proper evaluation of panel filters in respect to electrostatic filters. While most of the air filter manufacturers recognize that these two methods of air cleaning are entirely different and are effective on different types and sizes of dust, this new code does not give any information that would allow the prospective user to make such an evaluation for himself. Test data presented to show efficiencies of all classes of filters as compared to particle size and density would allow not only the proper selection of a cleaning device for a given condition but this information in itself would stimulate research on what constitutes the cleaning problem with respect to various dusts and particle size ranges.

The AFI filter code still leaves the air filter industry — which we feel is becoming more and more important — in the position of a major industry that has no standard unit of evaluation.

Certainly, the engineering profession has been able to select a standard method of rating power, heat transfer, air movement, etc., in such terms that the engineer who has a particular problem can properly evaluate the type and size of equipment needed for a given problem. This filter code still leaves filter application a matter of guesswork (or perhaps salesmanship.) The idea of rating a filter on one synthetic dust (which, true, is a mixture of several things) seems preposterous as a method of giving engineers information for solving air cleaning problems universally.

The code states that carbon, because it exists in the air, should be added to the mixture. This manufactured carbon, if it is collected by the mechanical filter in the test set, is only collected because it is fed to the test filter as an agglomerate or by being stuck to some of the lint or other dust in the mixture. It is interesting to note that the argument presented against sampling the air for evaluating efficiency is that a final dust balance can be made between the absolute filter and the weight of the test filter. The amount of dirt caught by the test filter is of course part of the control. Certainly, sampling can be proved out in the same manner by weighing the amount of dust collected by the filter being tested and checking this with the efficiencies indicated by sampling.

This new code recommends a type of material as an absolute filter. Our own laboratory tests indicate that this so-called absolute filter has an efficiency of less than 90 percent when tested on 0 to 5 micron dust that has been extracted from the "Arizona road dust fine" that is prepared and classified by the AC Spark Plug Div. of General Motors. This efficiency is a weight efficiency evaluated by sampling methods.

These are merely criticisms of individual phases of this code. Our basic objection, however — which we do not want to lose sight of — is that the code itself is merely a comparative method of rating certain limited types of air cleaning devices and does not provide any incentive toward true understanding of the basic dust problems that engineers have to face all over the country today. The code offers no incentive for anyone to determine his dust problem as far as density, particle size, etc., as after he has this information, no manufacturer's ratings under the proposed code give him any information as to what cleaning devices can be expected to do on the determined problem.

We feel that the proper test code should allow filters to be evaluated on the basis of efficiency versus particle size with different densities. Such information would lead to a family of curves which would allow the engineer or prospective user who knew his dust problems to properly select adequate air cleaning equipment. It would also provide the information to allow the proper economic application of the different classes of cleaning devices — electrostatic, strainer, impingement and cyclonic type filters. Such a test code would not only give engineers and users a better chance of evaluating present cleaning devices, but would be a strong spur toward research and development for the improvement and application of all air cleaning devices.—R. S. FARR, Farr Co.

L. L. DOLLINGER, JR. —

"New Code Offers Great Advantages"

OUR COMPANY — after many years of working with air filtration problems — is, along with many others, not in agreement with the current ASHVE code which was written in 1933. The principal reason is that there are too many factors in the use of this code — notably, the sampling of a portion of the air, which does not lend itself to the best results.

The new AFI code (described in the June HPAC), on the other hand, eliminates sampling and many other

of the engineering objections to the old code.

This code represents the experience of major manufacturers, with many years of experience in air filtration problems. We believe it offers great advantages in giving more accurate and positive information to prospective users of air filtration — LEWIS L. DOLLINGER, JR., Vice President, Dollinger Corp.

George F. Landgraf —

"This Code Has Many Weak Points"

I WOULD LIKE to comment on the Air Filter Institute's proposed new code, which was described in the June HPAC.

High efficiency removal of particulate matter (consisting of smokes, dusts, mists and fumes) from air streams should be the objective of any filtering device. The characteristics of the aerosols which affect the performance of an air cleaner include particle size, concentration, shape, density, electrical resistivity, velocity and surface characteristics.

The most important of these is size. Particles larger than 10 microns settle rapidly. Particles less than 1 micron in diameter settle so slowly that ordinary convection currents prevent sustained downward motion and such particles remain in the air for long periods.

Particles in the atmosphere can range in size from less than 0.01 micron up to things which are caught by an ordinary fly screen — such as lint, feathers, and bugs. Almost all conceivable shapes and sizes are represented. The material is very commonly soot, ash and soil, but may include particles of almost any inorganic or organic material and even such living organisms as virus, bacteria and fungus spores.

Because of the wide range of conditions it seems essential to be able to test a device under actual operating conditions as installed. For this purpose a weight test is impractical because of the small amount of material present. Even if sufficiently sensitive weighing equipment could be devised, a weight test would still not be the best evaluation. A 70 micron particle can just pass through a 200 mesh screen and would weigh as much as 12,000,000 particles of 0.3 micron diameter. So a weight test is insensitive to fine particles if large particles are present.

While I agree that the 1933 ASHVE air filter code is inadequate for proper evaluation of filters, I cannot see how this unauthoritative and hastily devised AFI code, which contains many of the weak points of the former one, can serve any useful purpose. The disadvantages of the AFI method might be summed up as follows:

1) The test dust is not characteristic of atmospheric dusts.

2) The particle size of the dust is not stated.

3) This test requires a lengthy period of time to run.

4) A balance of the capacity to weigh the sample would require unusual accuracy for its size.

5) The test would normally not have an accuracy better than plus or minus 5 percent.

6) This test method is unsuitable for use in field testing.

7) The test equipment is bulky and needs a large blower and a source of compressed air.

8) It would appear that dusts which are heavy enough to fall onto the test filter would also be heavy enough to fall out in a duct rather than to enter the occupied space.

9) We would suspect the possibility of the "absolute filter" absorbing some moisture during the test, distorting the final weight (which should be very accurate.)

10. This test could be expected to indicate relatively high efficiencies with almost any kind of filter.

Since air cleaning devices installed in buildings are usually used to keep walls, equipment and furnishings clean, a discoloration test seems to be the best basis for evaluation. The discoloration testing method devised by Dill at the National Bureau of Standards [A Test Method for Air Filters, by Richard S. Dill, ASHVE Transactions, vol. 41, 1936, page 379] has withstood the test of time and serves as an accurate evaluation of any type of filtering device. This tester is now commercially available as a portable instrument which can be used by any engineer to evaluate air filters at the actual point of installation. It samples the actual atmospheric contaminants and does not require the use of artificially compounded test dusts. I would be happy to furnish specifications to anyone to build one for themselves or to engage in the manufacture of this device as a business enterprise. —GEORGE F. LANDGRAF, Vice President in Charge of Engineering, Trion, Inc.

[Further comment on the AFI's air filter code is to appear in HPAC next month.]

J. F. HIRSHFELD —

"Should Set Trend in Corrosion Protection Design"

THE APPROACH THE United States Steel Corp. has taken to the related problems of underground corrosion and electrical grounding — described by William E. Coleman and Harold G. Frostick in the April HPAC — represents a substantial advance in industrial thinking on these problems. A few electrical utilities have adopted a similar approach within recent years, but as yet it is limited to a few of the more progressive power companies. To my knowledge, this is the first case in which a large industrial company has deliberately related the problems of corrosion and grounding in the construction of a manufacturing plant.

It has been normal industrial design practice to develop electrical grounding solely to secure safety and proper operation of electrical equipment. Underground corrosion has in the main been neglected until substantial damage has occurred.

In a substantial number of problems on which our firm has worked, corrosion of underground cables and other utilities has been caused by galvanic cells created by the electrical grounding systems. In order to eliminate the corrosion, the grounding systems have been revised in a similar manner to that described by Messrs. Coleman and Frostick — often at much greater cost than would have occurred had the problem been considered when the plant was originally constructed.

The increasing use of electrical equipment in industrial plants — including modern electronic control equipment, which often has direct current components that can escape to ground — is increasing the grounding problem and corrosion resulting from grounding throughout industry. While grounding to water systems is often adequate from an electrical safety factor, it no longer is the proper solution in many cases from a corrosion and maintenance viewpoint.

Modern grounding systems should be properly engineered as important components in any industrial plant. The approach described in the April HPAC should set a much needed trend in industrial design.—J. F. HIRSHFELD, Vice President, The Hinchman Corp., Engineers.

ST. ANGELA CHURCH
Chicago, Illinois
M. J. HOLLERAN, INC., Heating Contractors

ANOTHER CASE OF **Copper** WHERE IT COUNTS

ISOMETRIC DRAWING FURNISHED BY M. J. HOLLERAN, INC., CHICAGO, ILLINOIS, Heating Contractor, shows how radiant heating panel was placed in concrete floor of Church. General Contractors: HENRY BROS. CO. Revere Distributor: H. W. BLYTHE CO. Mechanical Engineers: GEORGE W. HUBBARD & ASSOCIATES. Architects & Engineers: McCARTHY and SMITH, all of Chicago.

For heating churches there is nothing quite so satisfactory as a radiant panel heating system in a floor slab. Because, with this newest and most efficient method of heating, traditional church design may be maintained without sacrificing comfort. And for radiant panel heating there is nothing quite so satisfactory as copper water tube. For churches are built to last. And copper the "everlasting" metal has proved its enduring qualities through years of satisfactory service. Revere Copper Water Tube cannot rust, it's 60' lengths in soft temper are easy to bend and require fewer fittings.

Regarding the St. Angela installation, McCarthy and Smith, Architects and Engineers wrote, "We are pleased to see results greater than anticipated in comfortable room conditions, low water temperature and ease and economy in operation." Commented the Rt. Rev. Msgr. D. F. Cunningham, Pastor, "The radiant panel heating worked like a charm. Our parishioners were comfortable at all times, even on the coldest days."

Now, with restrictions on the use of copper ended there isn't any reason why you can't use Revere Copper Water Tube for radiant panel heating, hot and cold water lines, underground service lines, processing lines, and waste stack and vent lines. See the Revere Distributor nearest you today. And, if you have technical problems, he will put you in touch with Revere's Technical Advisory Service.

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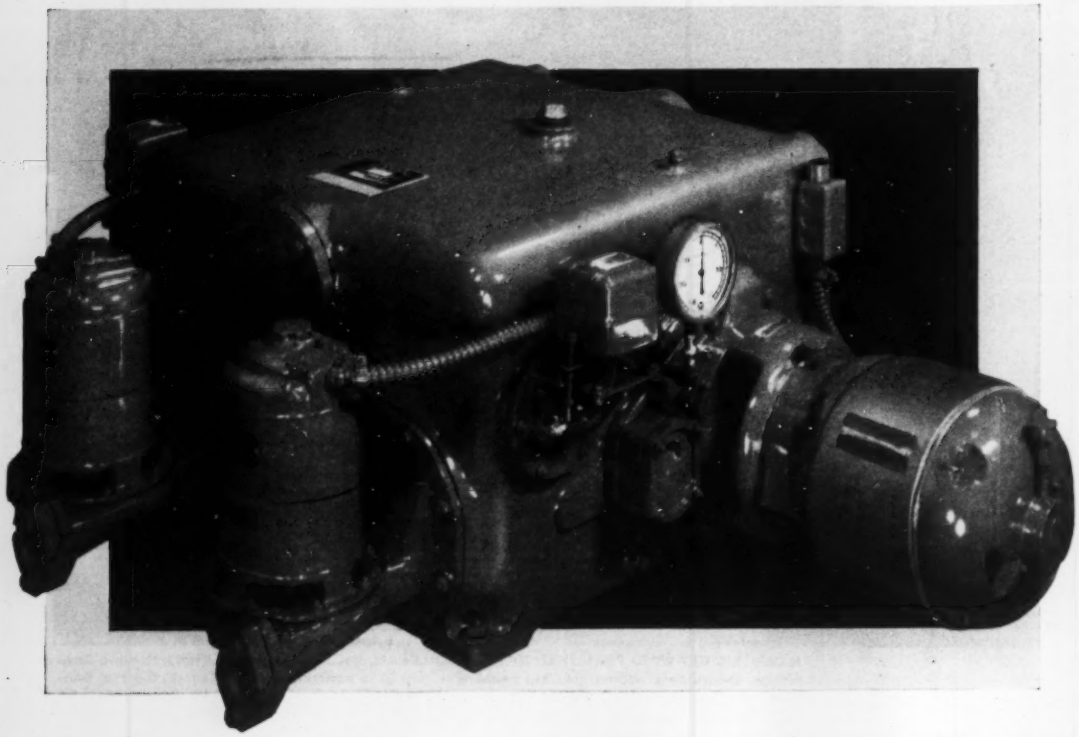
THIS NEW VACUUM HEATING PUMP

HAS THE INCREASED AIR CAPACITY EFFICIENT HEATING PRACTICE DEMANDS



It's the Nash CSM

Designed and manufactured by the organization that made the Jennings Manifold Heating Pump standard of the Heating Industry, the new CSM incorporates every desirable feature architects, engineers, owners and operators have sought. Employing separate air and water pump elements, each with its own motor and each independently controlled by its own automatic switch, the capacities and arrangement may be widely varied to meet job conditions. For the first time, the engineer has the choice of realistic water and air capacities required for rapid system response without wasteful overheating.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY
437 WILSON, SO. NORWALK, CONN.

Methods of Making

Piping Flexibility

Analyses

Actual results obtained by various methods described in HPAC's extensive series of articles are analyzed and compared, with recommendations

By Sabin Crocker and Arthur McCutchan

THE RESULTS which have been presented in the series of articles initiated by the present writers in the June 1946 issue of HPAC are summarized here.

In accordance with the suggestion made therein, that advocates of the different methods of making piping flexibility analyses give brief descriptions of the applications of their preferred methods to one or more sample problems, a total of 13 solutions have been presented to the Z-bend single plane problem and 12 to the Hovgaard three-dimensional problem.

In all, 14 articles comprise this series. One author did not solve either sample problem, while two others solved only the one plane Z-bend example and another solved only the Hovgaard problem.

The authors' names, publication dates and description of method of analysis are listed in chronological order in Table 1, together with an indication as to the accuracy of results to be expected.

Many Variations

It may be noted from Table 1 and the bibliography of the initial article that many different variations of the basic systems for solving piping flexibility problems have been evolved during the past 30 years. Fundamentally, these are variations of one or another of the following five basic methods of approach: (1) analytical — or algebraic; (2) graphical; (3) grapho-analytical; (4) single force through centroid; and (5) model testing. All five are included among the contributions to this series as listed in Table 1.

The numerous variations within any one method differ from one another principally in the means used for systematizing the solution through providing a specific ritual to follow, some having a standardized form for tabulating step-by-step results. Distinctive names have been assigned by various authors to their particular systems of computation — such, for example, as "the tabular-integration method", "the matrix method", the "straight-line method", the "elastic-center method", the "grapho-analytical method".

Mr. Crocker is Mechanical Engineer, Ebasco Services, Inc., and is a member of HPAC's board of consulting and contributing editors. Mr. McCutchan is Chief Product Engineer, Tube Turns, Inc.

Among the more accurate systems, good agreement exists concerning the flexural properties of the individual elements such as the quarter bends and tangents which comprise a run of piping between anchors. For the sake of simplifying solutions in more than one plane (which are difficult enough at best) deflections of a minor nature often are ignored; e.g., the secondary deflection of a quarter bend subjected either to loadings perpendicular to the plane of the bend or to torsion. These secondary deflections assume greater importance where the flattening effect under sideways loading is taken into account. This was pointed out by Irwin Vigness, as noted in the introduction article of this series. The effect of taking secondary deflections into account is discussed by H. V. Wallstrom in the May 1947 issue.

In preliminary comparisons of different piping layouts, square-corner approximations are frequently used instead of introducing all the complications of curved pipe, including flattening of the circular cross section during flexure. In final solutions for accepted layouts, however, the need for reasonable accuracy usually demands that curved pipe be treated as such, and that one of the more exact methods be used.

Granting general acceptance of the flexural properties of the individual elements as outlined above, the solution of piping flexibility problems by analytical or grapho-analytical methods then becomes a matter of superposing the deflections of one element on another in going progressively from one end of the line to the other. In this way it is possible to arrive at the overall movements of the line, with a corresponding determination of bending moments, stresses and reactions at the anchor points, or elsewhere, if desired. Other methods, of which the elastic-center solutions of Carlier and Spielvogel are examples, use the same flexural properties for the individual elements in reducing them to equivalent lengths for combination in a direct solution without employing the superposing technique. Straight graphical methods are less exact, aiming for an approximate overall solution without attempting to take into account all the properties of individ-

TABLE 1—LIST OF AUTHORS, date of publication in HPAC, and description of method of analysis

Authors	Issue	Pages	Basic system	Means of solution	Author's designation of method	Aids to solution
Sabin Crocker and Arthur McCutchan	June 1946	69- 73	Introduction, presentation of two sample problems and extensive bibliography.			
S. W. Spielvogel	July 1946	78- 81	Single force thru centroid	Algebraic formulas	Elastic center	Systematized
M. J. Fish	Sept. 1946	83- 88	Single force thru centroid	Diagrams and moments	Graphical	Not systematized
W. G. Hooper	Nov. 1946	70- 76	Moments about three axes	Diagrams and moments	Tabular integration	Systematized
R. C. DeHart	Jan. 1947	91- 95	Moment distribution	Diagrams and equations	Moment distribution	Not routine
H. V. Wallstrom	May 1947	69- 74	Analytical	Algebraic formulas	General analytical	Systematized
Lale C. Andrews	Aug. 1947	73- 76	Scale model testing	Elec. strain gage heads Algebraic + similitude	Model test	Special equipment
Henri Carlier	Sept. 1947	86- 89	Single force thru centroid	Algebraic formulas	Central force thru centroid	Systematized
F. E. Wolosewick	Sept. 1948	78- 82	Single force thru centroid	———	Column analogy	
L. E. Partch	July 1950	92- 95	Single force thru centroid	Scale diagrams	Straight line	Systematized
T. E. Bridge	Feb. 1951	107-109	Single force thru centroid	Area moments	Thrust axis thru centroid	Not routine
J. E. Brock	July 1952	78- 81	Analytical	Algebraic formulas	Matrix	Systematized
Arthur McCutchan and W. P. Gregory	March 1953	92- 97	Graphical and analytical	Area moment diagrams and formulas	Grapho-analytical	Systematized, visual

ual elements or how to superpose one on another. These methods, while admittedly less accurate, are valuable tools which the analyst may use as a guide in making preliminary layouts.

In More Than One Plane

With piping in more than one plane, and particularly where there are lateral branches involving more than two anchor points, the solution of numerous simultaneous equations is involved in obtaining an answer. The solution of such problems is difficult at best; the less rigorous methods are apt to give erratic results and are of doubtful value here.

The more exact methods of piping flexibility analysis have a routine procedure for going from one step to another in an orderly manner and for keeping track of the computations. Several authors have evolved forms to standardize and facilitate this procedure. In some arrangements an experienced technician sets up the problem and then leaves a calculating machine operator to compute results according to the standardized form. This results in a minimum use of technical talent. Others, such as the grapho-analytical method, demand the understanding of an engineer or a trained technician.

Somewhat different conditions obtain in determining the flexibility of a line by model testing, as illustrated in the article by Lale C. Andrews. While the model can readily be set up for testing a line in space, with or without branch connections and additional anchor points, the problem remains of converting the scale model observations to full line-size figures. Further complications arise through the usual practice of using solid rods instead of scale tubing in the model, thus introducing further complications with respect to torsion and flattening of the circular cross section of bends during flexure. In the case of the Z-bend problem, the forces and moments obtained using solid rods were approximately 25 percent greater than when using scaled tubing.

Contributions "Gratifying"

The purpose of the series may be re-stated as an intent to exhibit several alternative methods that are available for solving piping flexibility problems with a view to: 1) making more engineers aware of the variety of methods from which to choose; 2) promoting better understanding of how to solve actual problems; 3) providing bases for determining the applicability of different methods to specific types of problems; 4) indicating which methods are easiest to solve for a given degree of accuracy; and 5) encouraging further search for that ultimate method which has been wanted for years whereby any novice can learn to work a complicated flexibility problem with a minimum of effort.

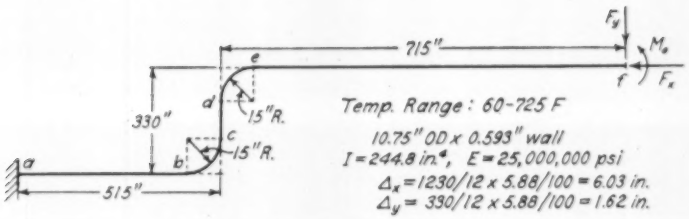
The number and quality of contributions to the series has been most gratifying. A sufficient variety of material has been obtained to do much toward satisfying the objectives enumerated in the preceding paragraph. In summing up the series, it is impossible to say to what extent these objectives have been met because that lies in the realm of what the individual reader gets out of the different articles; it is possible, however, to tabulate the results for ready comparison.

Z-Bend Problem

The results for the Z-bend sample problem are compared in Table 2. The resultant force has been computed in each case, where not given by the author. The resultant forces are found to be in much closer agreement than the individual components.

In order to have a common basis for comparing the results from the several methods, the bending moment at the most highly stressed elbow, point "e" of the Z-bend, was computed from the reacting forces and end moments given by each author.

The bending stress in the straight



Z-Bend with welding elbows

TABLE 2—Z-BEND SAMPLE PROBLEM—comparison of results

	Resultant Force	F_x Force	F_y Force	Bending moment, ft-lb M_a	M_{fg}	M_c	Bending stress at "e" Straight pipe	Elbow
S. W. Spielvogel	2,860	2,640	1,100	15,200	26,800	(37,400)	(9,870)	(16,450)
M. J. Fish (Square Corner)	3,450	3,178	1,301	15,141	30,817	46,700	12,330	—
W. G. Hooper (Square Corner)	3,750	3,472	1,419	16,360	35,603	50,700	13,380	—
R. C. DeHart	2,960	2,730	1,130	14,200	25,600	(40,200)	(10,610)	—
H. V. Wallstrom	2,790	2,580	1,070	12,620	25,936	36,336	9,590	(15,990)
Lale C. Andrews (Tubing)	2,780	2,571	1,054	12,444	24,666	(36,800)	(9,710)	—
(Solid Rod)	3,510	3,254	1,327	14,125	31,915	(45,300)	(11,960)	—
Henri Carlier	2,800	2,590	1,074	12,700	26,100	36,500	9,640	16,060
L. E. Partch	2,940	2,841	762	6,250	6,250	39,000	10,300	—
T. E. Bridge	2,710	2,500	1,020	11,382	25,202	(35,800)	(9,450)	(15,750)
J. E. Brock*	2,790	2,579	1,068	12,633	25,955	(36,300)	(9,580)	(15,970)
A. McCutchan (Arcs)	2,760	2,553	1,051	12,160	25,200	36,000	9,500	15,840**
and W. P. Gregory (Sq. Corner)	3,730	3,456	1,412	15,660	33,600	50,700	13,380	22,300**

*Values not given in article, but obtained from author.

**Values about 1 percent lower than given in article to place all results on a common basis, using mean radius of pipe wall and same value of Beta. Values of bending moment and stress in parenthesis were computed for the most highly stressed elbow and adjacent pipe where author did not give them.

Stress in pipe = $(5.375/244.8)\ 12M = 0.0220 \times 12 \times M = 0.264M$

Stress in elbow = $\beta(5.078/244.8)M = 1.77 \times 0.0207 \times 12M = 0.440M$

pipe at point "e" was determined from the properties of the pipe and the bending moments in the usual manner.

Application of Beta Factor

The intent of the several authors as regards application of the Beta factor for stress intensification at the elbow was not clear in the case of solutions using square corner approximations or model tests of the Z-bend. Because of this uncertainty, stresses in the most highly stressed elbow are not shown for solutions by Messrs. Fish, DeHart, Andrews and Partch. Where the extra flexibility of the elbows was definitely taken into account in the solution, Beta was applied in this tabulation for stress in the elbow, although not covered in the articles in question. This applies to solutions by Messrs. Spielvogel, Wallstrom and Brock.

In the late W. G. Hooper's solution, the welding elbows were stated to be equivalent to the amount of straight pipe in a square corner analysis and no provision was considered necessary for flattening of the elbow. The stress in the elbow is therefore shown to be the same as in the adjacent straight pipe.

It is apparent that omission of Beta in the case of square corner solutions for this particular example gives results which are numerically closer to the more exact results obtainable when arcs are taken into account than if Beta were applied. However, the omission of Beta, 1.77 in this example, gives stresses considerably lower than the more exact values. As stated by McCutchan and Gregory "the safer procedure would seem to be to apply stress intensification factors to the square corner solutions, although the results may in some instances be unduly conservative."

Three Dimensional Bend

The results for the Hovgaard three dimensional pipe bend are compared in Table 3.

Messrs. Fish and DeHart did not furnish solutions for this problem, and consequently are not listed in this table, although both can solve such problems by their methods.

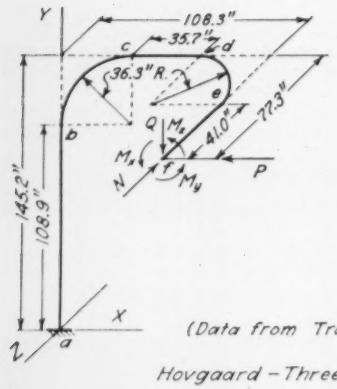
Since this example attributed to Hovgaard does not include the extraneous movements of the turbine, which were involved in the original Hovgaard solutions, it is not possible directly to compare reacting forces and moments obtained by the several authors with Hovgaard's values.

The resultant forces were computed, where not given in the respective articles. As in the case of the Z-bend problem, the resultant forces from the different solutions are in much better agreement than the component forces.

The location of the maximum bending moment at the left end, point "a", seems to be well verified by the solutions taking arcs into account. The square corner approximate solutions of Hooper and that of McCutchan and Gregory both indicate maximum moment at point "bc", which is the square corner substitute for the pipe bend. This difference in location of maximum bending stress between approximate solutions and the more exact solutions was called to attention by McCutchan and Gregory.

Beta in this case is practically unity (1.017), so its application or neglect is of little significance. Bending stresses are shown only where given in the articles, since the individual bending and torsional moments are more revealing of differences in the results.

Minor differences in the magnitude of the forces and bending moments are noted in comparing solutions



Temp. Range: 0-850 F

7.288" OD x 0.241" wall
$I = 33.14$ in.^{4}
$E = 24{,}000{,}000$ psi

$\Delta_x = 108.3 \times 0.006083 = 0.66$ in.
$\Delta_y = 145.2 \times 0.006083 = 0.88$ in.
$\Delta_z = 77.3 \times 0.006083 = 0.47$ in.

(Data from Trans. ASME, Vol. 57, No. 7, Oct. 1935, p. 413)

Hovgaard - Three dimensional pipe bend

TABLE 3—HOVGAARD THREE DIMENSIONAL BEND—comparison of results

	Resultant Force	F_x P	F_y Q	F_z N	Bending moment, ft-lb: M_x	Left end M_y Torsion	M_z	Right end M_x	M_y	M_z Torsion	Location M_{max}	Stress, psi
S. W. Spielvogel	2,605	1,777	1,796	638	4,518	1,080	11,180	8,255*	6,750*	5,884*	a	
W. G. Hooper (Square Corner)	2,562	1,766	1,752	608	4,650	770	10,138	8,579*	6,659*	4,580*	bc	15,253 S_B; 508 S_T
H. V. Wallstrom												
(Inc. Sec. Terms)	—	1,750	1,720	640	4,610	1,150	11,090	7,970	6,650	5,450	a	
(Neg. Sec. Terms)	(2,530)	1,750	1,710	640	4,670	1,200	11,090	7,920	6,710	5,280	a	
Lale C. Andrews (Tubing Model)***	(2,500)	1,752	1,711	642	5,735	1,524	10,479	8,953	6,932	4,720	a	
Henri Carlier	(2,770)	1,836	1,958	718	4,500	1,412	11,500	8,750	6,750	7,450	a	
L. E. Partch**	2,709	1,488**	1,995**	1,062**	8,017**	2,442**	6,583**	8,017**	2,442**	6,583**	a	14,000
T. E. Bridge												
(Square Corner)	3,000	2,000	2,010	890			Not given separately				a	17,250
(Arc Considered)	2,150	1,445	1,440	640			Not given separately					12,400
J. E. Brock	2,580	1,768	1,771	621	4,500	977	11,150	8,381*	6,762*	5,737*	a	
A. McCutchan (Arcs) and W. P. Gregory (Square Corner)	2,580	1,769	1,765	630	4,480	1,042	11,200	8,260	6,740	5,690	a	15,856†
	2,630	1,832	1,788	610	4,670	717	10,620	8,800	7,000	4,550	bc	15,874†

*Values not given in article, but obtained from author.
**Values not stated in article but obtained from author.
***Solid rod models customarily are used, according to author.
†Stress intensification factor $\beta = 1.017$ included in both analyses for stresses at points "bc" and "c", respectively.

made by methods which are to all intents and purposes identical. These are believed, for the most part, to be computational errors, although some may result from inclusion of secondary effects or their partial inclusion as may be noted in the two solutions given by H. V. Wallstrom.

The model test using carefully scaled tubing in the case of the Hovgaard bend gives good substantiation that most of the methods give results in line with the physical facts. Where the value of the flexibility factor, K, is approximately 0.5 for a bend ($K = 0.44$ for Hovgaard bend), it would seem that a sharp corner solid rod model should be a good representation of the line in question.

Where K is approximately 0.2, as in the case of the welding elbow in the Z-bend example, the solid rod model apparently gives answers equal to a square corner approximation.

Several Sound Methods

This series of articles has demonstrated that several mathematically sound and satisfactorily accurate methods for solving piping flexibility problems are available.

No really simple means for solving complicated problems in space (more than one plane or having more than two anchor points) has been offered so far, however. Irrespective of which method is used, the more intricate problems still have to be set up by or solved under the direction of experienced piping flexibility analysts. Choice of method in the past has been to a large extent a matter of personal preference and the accuracy sought. Proponents of the alternative methods often are rather partisan in adhering to their own choice but usually agree that any of the several so called "exact" methods will give a satisfactory answer to piping problems.

Once learned — and aside from experimenting to find a better method — it probably is advisable for the piping designer to follow a method familiar to him in making flexibility calculations. It is sometimes urged that preliminary flexibility calculations while a piping layout still is in a tentative stage should be made hurriedly by an approximate method differing fundamentally from the final solution. Those charged with doing the actual calculations usually resist having to learn a different method for short-cut solutions, contending with considerable reason that the short-cut can be made to best advantage by the familiar basic method but using simplifications such as square corner approximations. This view would seem to be well taken in most cases, unless one of the tabular or chart solutions mentioned in the introductory article of this series is readily applicable.

"Conditioning" Air for Health, Safety

PREVENTION OF AIR contamination or pollution in its broadest sense was discussed at most of the session meetings of the annual convention of the American Industrial Hygiene Association, which was held in Los Angeles this year.

As has been the practice in the past, the AIHA met jointly with four allied organizations — the American Conference of Governmental Industrial Hygienists, the Industrial Medical Association, the American Association of Industrial Nurses and the American Association of Industrial Dentists. In addition, the health and safety division of the Atomic Energy Commission and the U. S. Navy industrial health organization held meetings in Los Angeles during the same period.

Even though these organizations meet jointly, each is individually responsible for its own separate program — with the result that many concurrent sessions are in progress continuously. About 1500 persons attended the conference.

Following the precedent established at the annual convention in Cincinnati last year, the AIHA again resorted to concurrent sessions in order to cover all aspects of the subject matter it encompasses in the short time available. Since the AIHA is concerned primarily with controlling those factors of, or transmitted through, the air which if uncontrolled may produce discomfort or disease, many of the papers given are of interest to heating, ventilating and air conditioning engineers.

The AIHA's first technical session was devoted to a discussion of health hazards attending the mining, processing and handling of certain radioactive materials (such as radium, thorium and uranium.) These papers are of particular interest to those who are faced with the problem of controlling atmospheric contamination by radon and its daughter products. The subject matter of the second session was general in nature and not of great interest to readers of HPAC.

Noise a "Contaminant"

The various aspects of noise were discussed at the third technical meeting. Noise is one "atmospheric contaminant" which is not controllable by ventilation. It is, however, of as great concern to the industrial hygiene engineer as are the more usual contaminants. The basic concepts for control are quite similar also. The next meeting was devoted to toxicology of certain contaminants.

The next three technical sessions were held concurrently. One was on toxicology, one on air pollution, and one on engineering. The papers given at the engineering session are of interest to ventilating engineers, especially those engaged in industrial work.

George Reichenbach spoke on ventilation for ship construction and repair. He pointed out the difficulties encountered in shipbuilding and repairing insofar as adequate ventilation is concerned. Specific examples were cited of ventilating enclosed interior tanks while spray painting.

J. F. Knudsen showed how adequate dust control many be accomplished at ore crushing and handling operations by appropriate hooding and local exhaust ventilation. G. A. Johnson discussed an unexpected arsine problem and how it was overcome.

Dust Collection, Filtering

J. R. Kayse presented and discussed a unique chart which is useful in selecting the class or type of dust collector for any local exhaust system if certain parameters of the dust are known.

A. T. Rossano presented a paper on electrostatic effects in fiber filters for aerosols. He described how these effects are measured and what part they play in air cleaning by conventional fiber filters.

Knowlton Caplan reviewed recent developments in reverse jet air filtering. Reverse jet filters or dust collectors are of fairly recent origin. They are, in effect, very efficient fabric filters in which the air to fabric ratio is in the order of 15 to 1 rather than 3 to 1, as is a common ratio for conventional bag house type dust collectors.

The last group of technical sessions comprised concurrent meetings on radiation, chemistry and analysis, and engineering and air pollution. The first dealt with the determination and control of radioactivity. The session on chemistry and analysis was devoted to discussions of determining by physical or chemical means the composition and amount of air contaminants.

Several of the papers given at the engineering and air pollution session are of particular interest. J. C. Radcliffe presented case histories of collecting efficiency tests on a large number of different kinds of dust collectors on a variety of process or local exhaust systems. N. W. Clauss showed how air pollution from sulfuric acid recovery processes may be reduced. R. J. Ruff discussed the design considerations for using catalytic combustion equipment on stacks or operations handling combustible gases or vapors.

The next meeting of the AIHA will be held in Chicago the latter part of April 1954.—ALLEN D. BRANDT, Chief Industrial Hygiene Engineer, Bethlehem Steel Co.

Titles and authors of papers referred to above:

Ventilation for Ship Construction and Repair — George S. Reichenbach, Jr., Bethlehem Steel Co., Sparrows Point, Md.

Crushing Plant Dust Control at the Ray Mines Div., Kennecott Copper Corp. — J. F. Knudsen, Director, Industrial Hygiene Dept., Kennecott Copper Corp., Salt Lake City.

Engineering Notes Concerning an Arsine Problem — G. A. Johnson, St. Joseph Lead Co., Monaca, Pa.

Graphic Presentation of Contaminant Characteristics Encountered in Local Exhaust Systems — J. R. Kayse, American Air Filter Co., Louisville.

Electrostatic Effects in Fiber Filters for Aerosols — A. T. Rossano, Jr., U. S. Public Health Service, Harvard School of Public Health, Boston.

New Developments in Reverse Jet Filtering — Knowlton J. Caplan, 1724 Olive St., St. Louis.

Case Histories of Collector Efficiency Measurement Studies — J. C. Radcliffe, Industrial Health Unit, Ford Motor Co., Dearborn, Mich.

The Reduction of Atmospheric Pollution from Sulfuric Acid Recovery Processes — N. W. Clauss, Carbide and Carbon Chemicals Co., S. Charleston, W. Va.

Design Considerations for Application of Catalytic Fume Elimination — R. J. Ruff, Catalytic Combustion Corp., Detroit.

HPAC Contractors Consider Problems of Expanding Field

The year's progress and plans for the future reported

ROBERT W. LAWINGER was elected president of the Heating, Piping and Air Conditioning Contractors National Association. He heads the S. J. Reynolds Co., of Chicago

THE EXPANDING applications of and the market for air conditioning, piping and heating services in industrial plants and buildings of all types were the general theme of the 64th annual convention of the Heating, Piping and Air Conditioning Contractors National Association, which was held in Chicago at the Edgewater Beach hotel. Better installation methods and procedures and ways for the heating, piping and air conditioning contractor to assure his getting his full share of business were stressed in committee reports, talks and panel discussions.

Close to 900 attended the convention, which had been planned by the Chicago association's convention committee under the chairmanship of Joseph S. Kearney. Membership of the HPACCNA totals 1200.

"Contract for Entire Job"

In his official address following the welcoming speeches, retiring national president William W. Murray, Jr., pointed out that few buildings will be built that will not include air conditioning. He said that HPACCNA member firms should organize their facilities so that "we can contract for the entire job", keeping the work that must be sublet to the minimum.

He said that any firms doing any part of an air conditioning job — such as refrigeration work, sheet metal, etc. — should join the association, as should any firms installing any of the "new and different" heating systems. He said that a change in the association's constitution would stress that the HPACCNA includes within its scope "*all* systems of heating, cooling, ventilating, refrigeration, air conditioning, power piping, industrial and process piping, sprinkler piping, temperature control piping, high and low pressure boilers, stokers, oil burning equipment, gas burning equipment, pneumatic and hydraulic piping, and insulation, painting and sheet metal work as required by such installations." A trade promotion program is to be formulated to aid members to perform all work within this scope.

"Bid-Shopping" Act

A federal construction act regulating bidding on government contracts and aimed to eliminate bid shopping on the part of general contractors has been introduced in the new Congress, with a good chance of its becoming law (in the association's opinion).

It was also reported that the association withdrew from the national joint board on jurisdictional disputes, as it was felt the mechanical specialty trades did not have enough representation ("40 percent of a building comprises the mechanical specialties," it was stated.) A committee is studying the matter of increased representation on this board.

"Expanding A.C Market"

William S. Bodinus, chairman of the air conditioning committee, said in his report that "the great expanding air conditioning market" has three phases: 1) industrial and commercial central systems; 2) self-contained units; and 3) year 'round residential air conditioning. He said that continued stress had been placed on air conditioning installations by HPACCNA members, that a study had been made on heat pumps (information being on file at association headquarters), and that — in cooperation with the market research committee — the residential heating trend and the effect that air conditioning may have on the heating systems installed in the residences of tomorrow had been analyzed. It was concluded that air conditioning will be one of the sales features "of the residence certainly $15,000 and higher in cost", with a good possibility of this being true for the $10,000 home.

Austin S. Ford, chairman, reported for the refrigeration committee that the refrigeration section of the Instruction Manual for Steamfitting Apprentices is to be thoroughly revised and rewritten because of the rapid growth of this phase of the contractor's business. It should be ready by the time of the next annual convention, he said.

Mr. Ford said also that some attempts were being made in two or three cities to "whittle away" at refrigeration work. In the case of one proposed city ordinance, he stated that the ASA B9 code on refrigeration was being misconstrued. This code does not apply to the use of chilled water or air as refrigerants, he said, and to construe it as pertaining to piping chilled water or conditioned air from the health aspects is an error. The heating, piping and air conditioning contractors in that city are fighting the proposed ordinance, and "such attempts in other places should be watched carefully," he warned.

Air Conditioning Department

As has been the custom at HPACCNA conventions in recent years, a number of informal panel sessions or discussions on various subjects were on the program.

At the air conditioning panel (Mr. Bodinus presiding), Herbert Kreisman, vice president of the Advance Heating & Air Conditioning Corp., Chicago, said this contracting firm had gone actively into the air conditioning field in 1935. Before that, they had depended to a great extent on manufacturers of equipment. They felt at that time — as they still do — that air conditioning would be the business of architects and consulting engineers, who would want to let one contract for the heating, piping and air conditioning services for a building. Air conditioning now represents one-third to one-half of Advance's total operation, he said.

A mechanical engineer was hired, with air conditioning as his exclusive responsibility. There are contact men, sales engineers, an air conditioning construction department, and a service department with servicemen available 24 hr a day, seven days a week. The sales engineer is the "job coordinator."

On actual construction, the regular pipefitters do the work; some of them specialize on refrigeration, but also do heating work. The same is true of the servicemen. This irons out the peaks and valleys which a straight heating or a straight air conditioning organization would have, he said. The ventilation work is subcontracted.

He mentioned that there are two general types of work: 1) Putting in a job based on a consulting engineer's specifications; and 2) installing jobs not serviced by a consultant, thus necessitating design and usually involving a performance guarantee. In recent years, self-contained units (up to 5 tons) have been used more widely on the smaller jobs, and selling such jobs involves a good bit of merchandising.

He suggested that contractors shouldn't "compromise" — that they should get into the air conditioning business "with both feet" — and that as the air conditioning part of the business is built up, the contractor should have his own service department. He mentioned in answering a question from the audience that service time is charged from the time the serviceman leaves one job until he finishes the next job.

Central vs. Packaged

J. J. Floreth, vice president of Westerlin & Campbell Co., discussed packaged and central station air conditioning equipment from the standpoint of proper selection for individual projects. He said that several factors influence the choice for a specific job, including: 1) initial cost — which should not be lowered by compromising good engineering; 2) operating cost — which is a constant expense over the life of the installation; 3) physical adaptability to the structure; 4) special design problems; and 5) maintenance expense — even packaged units require experienced air conditioning servicemen.

The choice between packaged or central station air conditioning depends on careful engineering and economic analysis, he said in summary. A job may be analyzed by: 1) preparation of a single-line sketch; 2) preliminary tabulation of various possible types of systems and equipment; and 3) a final comparative detailed analysis of two or three systems best suited to the application.

At the same session, George Robinson, of Carrier Corp., said that residential air conditioning is "the hottest subject in the field today."

New Pipe Welding Procedures

Richard S. Tobin, chairman, gave the report of the welding committee:

At the 1952 convention, this committee recommended that the association's board of directors appropriate $5000 to the National Certified Pipe Welding Bureau to help defray the cost of research and development of procedure specifications for welding of stainless steel and aluminum pipe and piping materials. In return, the HPACCNA would receive any procedure specifications that were developed as a result of this work. As a result, the following new welding procedure specifications are available:

No. 5 for helium shielded tungsten arc welding of aluminum pipe, fittings and flanges.

No. 7 for metallic arc welding of austenitic stainless steel pipe, fittings and flanges.

No. 8 for inert gas shielded tungsten arc welding of thin wall austenitic stainless steel pipe, fittings and flanges.

Another recommendation of the welding committee was that procedure specifications Nos. 1, 2 and 3 be printed individually. This recommendation has been carried out, he reported.

The committee also recommended that the committee on standards provide a new section in the National Association Engineering Standards to contain all pipe welding procedure specifications that have been or may be adopted by the association. The standards committee took favorable action on this matter and the Standards now has "Section VII" which contains eight pipe welding procedure specifications.

As a result of all this work and the fulfillment of the recommendations, the members of the HPACCNA now have in their possession standard welding procedure specifications that are equal to or better than any developed to date, he said. It has been proved that welding performed in accordance with these procedure specifications can comply with the requirements of Section IX of the ASME power boiler code and the AWS qualification standards.

He recommended that the welding committee continue to keep itself informed of the use of new piping materials, and as their use becomes common to see to it that welding procedure specifications providing the best methods for fabricating them are developed and made available.

Pipe Welding Bureau

W. R. Stevens, chairman of the board of trustees, reported for the National Certified Pipe Welding Bureau and mentioned that the three new standard procedure specifications

had cost $12,000 to develop and qualify. He said that the bureau is now a recognized authority in the pipe welding field, and that it is qualifying procedure No. 9 for welding aluminum pipe.

Regular requests from manufacturers who would like to join the bureau to obtain the qualified procedures are received. However, the rules provide only for membership of those engaged in piping construction.

He reported that the bureau now has 22 chapters who have qualified 1482 welders. He said that the necessity of complying with the code on pipe welding is spreading fast, and advised the formation of chapters in other areas. He pointed out that it usually takes some time for a new chapter to become active after it is organized.

"Competitive" Pipe Welding?

Much of the discussion at the informal round-table session on pipe welding revolved around the question, Can there be different qualities of welds? Some opinion was that, because of competitive reasons, perhaps there should be one quality of weld for, say, a 5 lb heating line or condenser water line as compared to 2000 lb piping in a refinery. One contractor said that for some low pressure piping, the pipe was not grooved; just the outside circumference of the pipe is welded, "wrapping it around," and that on some types of jobs this works out okay.

Other opinion was that there can be only one quality of pipe welding, no matter what the type of job, and that it is just as cheap to make good welds as poor welds if the welders are properly trained. There should be no pipe welds not as good as the base metal, it was stated.

The importance of properly trained welders was cited in a discussion on the re-welding of pipe joints, which — for example — might cost $12 to $14 for a joint instead of $3 because of the first cost, cost to cut out the bad weld, cost to re-weld, which may take twice as much time, etc.

The possibilities of using down-hill welding for piping were discussed at some length, as the consensus seemed to be that three welds could be made down-hill in the same time required for one weld up. Robert S. Green, technical consultant to the National Certified Pipe Welding Bureau, believes welders can be trained to do down-hill welding properly and that a procedure could be developed for its use on carbon steel ("which represents 80 percent of the welding being done today in the heating, piping and air conditioning industry.")

The session (at which Mr. Tobin presided) indicated that now that piping contractors are doing so much welding and labor costs are always increasing economical welding methods become more important all the time.

[Other of the talks and reports given at this important convention will be summarized in a second article.]

Big Chicago Building Being Air Conditioned

The Standard Oil Co. building at 910 S. Michigan will be one of the first of Chicago's large existing downtown office buildings to be completely air conditioned. Installation of the equipment is now being rushed.

Two 1000 ton centrifugal compressors will furnish chilled water for cooling; a cooling tower on the roof will supply condensing water. The compressors are being installed in basement space made available by the removal of direct current generators.

Chilled water for cooling, hot water for heating, and primary air for ventilation and dehumidification are furnished to room units throughout the building. The primary air, introduced through nozzles in the units, induces flow of room air over the cooling or heating coils.

An interesting feature of the installation is the method of handling small interior offices on the first floor, which space was formerly used for stores. Regular windows are being installed, with artificial lighting behind them to look like "outdoors." The air conditioning units in these interior rooms are installed under the "windows" just as they are in the rooms with outside windows.

The work is being done under a contract with Carrier Contracting Corp. The heating and piping subcontractor is Gallaher & Speck. Narowetz Heating & Ventilating Co. is the ventilation subcontractor.

Exhaust Fan Remedies a Sneezing Problem

A Camden, N. J., physician was of the opinion that the nose and throat condition of one of his patients was caused by something in his working environment, Preston C. Shimer, industrial hygiene engineer with the New Jersey State Department of Health, reports in the Public Health Service publication, Occupational Health.

The working environment was the heat treating department of a manufacturer of small cutting disks and cones. The man's job was the operation of an alkali cyanide case hardening process.

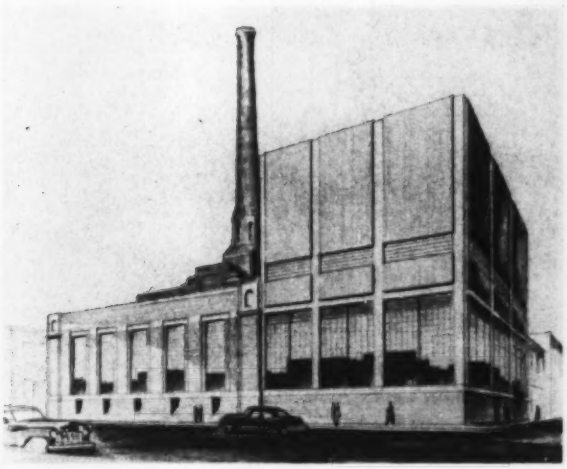
At the request of management, the Bureau of Adult and Industrial Health of the New Jersey State Department of Health visited the plant to conduct an environment study.

Suddenly (during the study) every occupant of the room began sneezing. A workman was adding a powdered alkali soap to the steaming vat used for cleaning and degreasing the small parts. The irritating effect of the soap powder immediately became suspect.

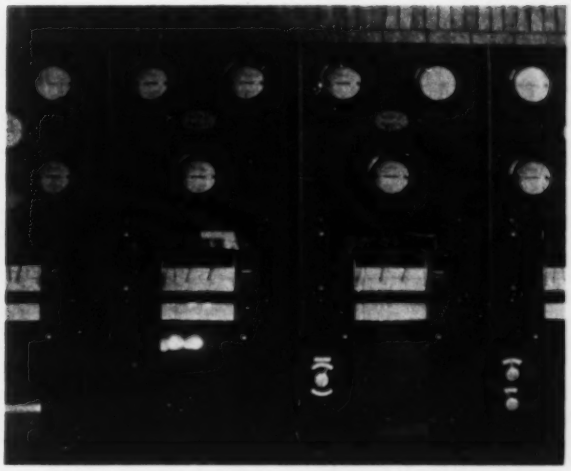
The installation of an exhaust fan at this bath, vented to the outside, removed this hazard and also reduced the humidity in the room.

The installation of two exhaust fans in the monitor roof over the cyanide process, for use mainly during the removal and quenching operations, resulted in rapid removal of the steam and vapors.

Sore throats and irritated nasal passages among the personnel disappeared, and management believed that the expenditure of under $500 was wisely made.



THE FRANKLIN heating station and refrigeration building supplies steam, water, electricity



PLANT EXPORT PANEL indicates and records the flow of steam and water from the station

The Franklin Heating Station

Supplying the necessary services to modern buildings — heating steam, process steam, air conditioning, etc. — is a big job. The facilities of the Franklin Heating Station, Rochester, Minn., are described briefly here

THE FRANKLIN HEATING Station, Rochester, Minn., is jointly owned by the Mayo Association and the Kahler Corp. It was designed to supply electric power, heating steam, process steam, cold well water, and hot softened water to the owners' buildings.

Original equipment consisted of three 35,000 lb per hr boilers, two 1000 kw double-extraction turbogenerators, two deep wells, three water softeners and the necessary condensers, pumps, switchgear and instruments essential to plant operation.

Construction of the building began in 1926 and was completed in 1928. Ellerbe and Co., St. Paul, were the architects, and N. D. Adams and Leopold Pistner the consulting engineers. Mr. Adams became plant superintendent in 1929.

In 1949 plans were made for enlarging the plant to accommodate the installation of two new 2500 kw turbogenerators, a 100,000 lb per hr steam generating unit and the necessary auxiliaries.

The refrigeration building adjacent to the station proper was also planned at this time and was designed for a total capacity of 6000 tons of refrigeration.

Its purpose is to furnish chilled water to the existing buildings in the system and to any future development. The present installed capacity consists of three 1000 ton centrifugal machines. Two of these machines are driven by 1095 hp low pressure steam turbines using extracted steam from the turbines driving the main generators. The third machine is driven by a 1035 hp high pressure turbine using steam from the main header.

Two induced draft cooling towers are installed within the structure, with space provided for two additional units. Each cell has a design capacity for cooling 6000 gpm from 105 to 85 F.

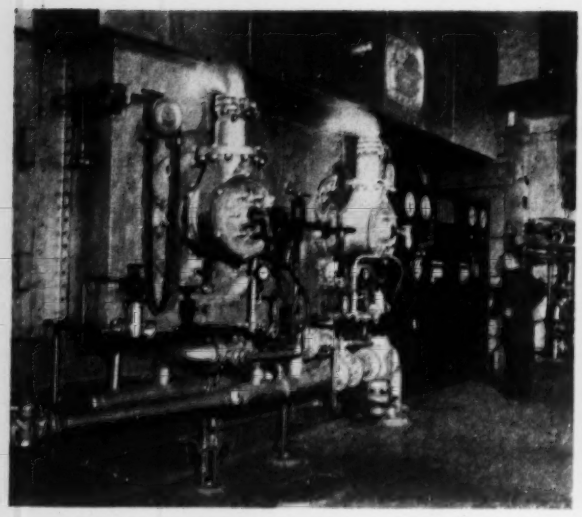
The following paragraphs present a brief outline of the plant operation with regard to steam and electrical generation and refrigeration.

Steam is generated in the station boiler room using one of three separate fuels or a combination thereof. These fuels are natural gas, fuel oil and pulverized coal. The fuel used is determined by the economy of operation and the availability of each.

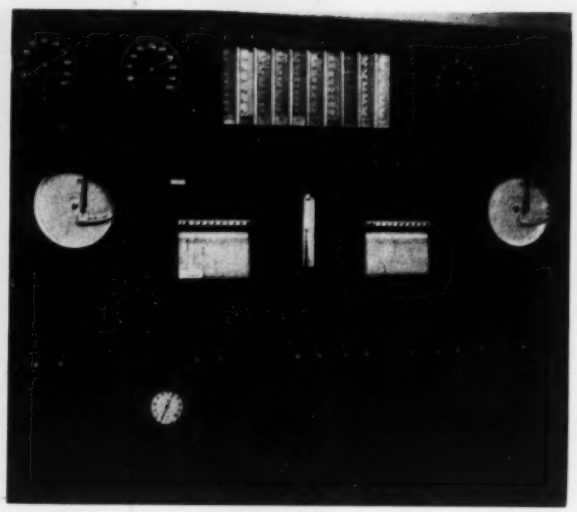
Steam generated at high pressure is expanded through the turbines driving the electric generators. The steam required for process work and space heating is extracted at low pressures and distributed to the buildings.

The steam which provides cooling for the latter stages of the turbine is condensed by well water which enters the condenser at 55 F and leaves the condenser at from 100 to 110 F. This water is then softened by sodium zeolite water softeners and distributed to the buildings as hot soft water when additional heat is added to obtain the final desired temperature.

Listed below are the operating characteristics of each of the four boilers, including steam output in lb per hr, steam pressure in lb per sq in. (psi) and steam temperature in degrees Fahrenheit.



STATION BOILER ROOM uses one of three fuels, or a combination thereof — gas, oil or coal



CONTROL PANEL for the No. 1 boiler provides for either manual or fully automatic operation

Boiler No. 1, 100,000 lb per hr, 425 psi, 750 F.
Boiler No. 2, 100,000 lb per hr, 300 psi, 600 F.
Boiler No. 3, 55,000 lb per hr, 250 psi, 600 F. (Reserve)
Boiler No. 4, 65,000 lb per hr, 250 psi, 600 F.

While 90 percent of the steam condensed in the buildings is returned to the plant for boiler feedwater, the remaining 10 percent must be added to the system from another source.

Raw well water passed through the two bed demineralizer is purified in two steps. Calcium, magnesium, sodium, carbonates, bicarbonates, sulphates and chlorides are removed, and the water leaving the unit approaches distilled water in purity. This system eliminates the possible formation of scale and sludge which occurs when feeding untreated raw water into the boilers.

The control panel for each boiler provides for operation of the boiler on either manual or fully automatic control.

When on automatic control, fuel flow and air flow to the furnace are constantly adjusted, in accordance with steam demand, through pneumatic signals. Instruments on the board are constantly recording such items as steam flow, steam pressure and steam temperature, as well as the carbon dioxide content of the furnace exhaust gases. These records give a constant indication of boiler performance and efficiency.

Increases in electrical power demands from buildings now under construction, and possible load increases in the future, necessitated enlarging the Franklin Heating Station to accommodate two 2500 kw turbogenerators in addition to the two 1000 kw machines in the original building.

These machines generate 2400 volt, 60 cycle, 3 phase power. Current from the generators in operation flows to the main switchboard. From the switchboard it is fed through separate feeders located in the service tunnels to each of the major buildings in the system. Transformers in the buildings step down the voltage to the desired value.

A 5000 kva tie line between the Station and the Rochester Silver Lake plant is mutually owned and maintained to the advantage of both parties for emergency purposes.

Station generating equipment consists of two 1000 kw turbogenerators designed for steam pressures of 250 psi and temperatures to 600 F; these machines are equipped for steam extraction at 90 psi and 10 psi and generate 2400 volt, 60 cycle, 3 phase power. In addition, there are two 2500 kw turbogenerators designed for steam pressures of 400 psi and temperatures to 750 F; these machines are equipped for single stage steam extraction at from 10 to 30 psi and generate 2400 volt, 60 cycle, 3 phase power or 4160 volt, 60 cycle, 3 phase power.

The operating control panel for the No. 1 turbogenerator contains instruments for recording flow, temperature, and pressure of the steam to the turbines as well as controls for the operation of the desuperheaters in the main steam lines. The various gages on the board indicate such items as condenser vacuum, water temperatures to and from the condenser, and oil temperatures. In addition there is an alarm system which notifies the turbine operator when and where trouble is encountered so that immediate steps may be taken to remedy the situation.

The master clock near the panel indicates whether current is being generated at exactly 60 cycles. If the frequency is not exactly 60 cycles, the clock indicates whether it is fast or slow and by how many seconds.

The instruments on the plant export panel are constantly indicating and recording the flow of 10 psi steam, 90 psi steam, hot water and cold water being distributed to the various buildings.

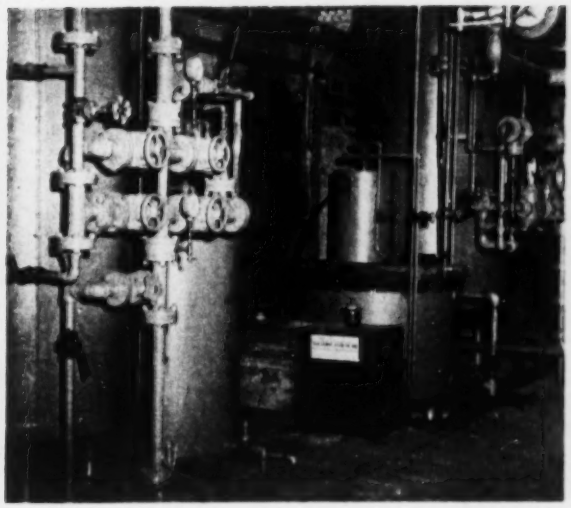
The panel also contains the necessary flow meters for No. 3 and No. 4 turbogenerators, measuring and recording steam flow to the turbines, steam extraction and steam condensed.

The total flow of water pumped from the two deep wells in the plant is also recorded on this panel.

The three 1000 ton centrifugal refrigeration machines presently installed have a total capacity equivalent to the refrigeration required to freeze 6 million lb of ice during a 24 hr period.

Machines No. 1 and No. 2 are driven by low pressure steam at 30

REFRIGERATION ROOM has three 1000 ton centrifugal refrigeration machines driven by steam



DEMINERALIZER purifies raw well water. Ninety percent of steam used in buildings is returned

lb per sq in. which is extracted from the turbines driving the main generators. The third machine is driven by a high pressure turbine using steam at 400 psi.

Condensing water for the refrigeration condensers and the steam condensers is obtained from the cooling towers in quantities up to 12,000 gpm. Water used in the cooling towers is softened by two 113,000 gal zeolite water softeners and is treated with sulphuric acid to give water suitable for the system.

Operation of the refrigeration system includes three separate cycles.

1) Chilled Water Cycle

Water is pumped through the refrigeration machine cooler where the temperature is lowered before sending the water out to the cooling coils in the building ventilating systems. Heat removed from the air in the buildings warms the water which is returned to the refrigeration building to be re-cooled.

2) Refrigerant Cycle

Heat removed from the water passing through the cooler is transferred to the refrigerant, causing it to boil. The compressor removes the vapors from the cooler, compresses them, and forces them into the condenser where the heat in the refrigerant is transferred to the cooling tower circulating water. The refrigerant then liquefies and is returned to the cooler where the cycle is repeated.

3) Tower Water Cycle

Water from the cooling tower is circulated through the refrigerant condenser where it picks up heat from the refrigerant. The water is then pumped to the top of the cooling tower where it falls through the fill to the pan below.

Water from the cooling towers is circulated through the refrigerant condenser, where it picks up heat from the refrigerant. It next passes to the condensers for the steam turbine drive and then is pumped to the top of the cooling tower, where it falls through the fill to the pan below.

Engineers, Contractors

Engineer in charge of engineering, design, and construction: N. D. Adams, Superintendent, Franklin Heating Station.

Consulting engineers: Refrigeration equipment — William Sturm, Ellerbe and Co. Power plant equipment — Leopold Pistner, Fuel Economy Engineering Co.

Architects: Ellerbe and Co.

General construction: O. A. Stocke & Co., Inc.

Power plant piping: Fuel Economy Engineering Co.

Heating contractor: The Sanitary Co.

Ventilating and air conditioning: Utility Sales & Engineering Co.

Insulation: G. A. MacArthur Co.

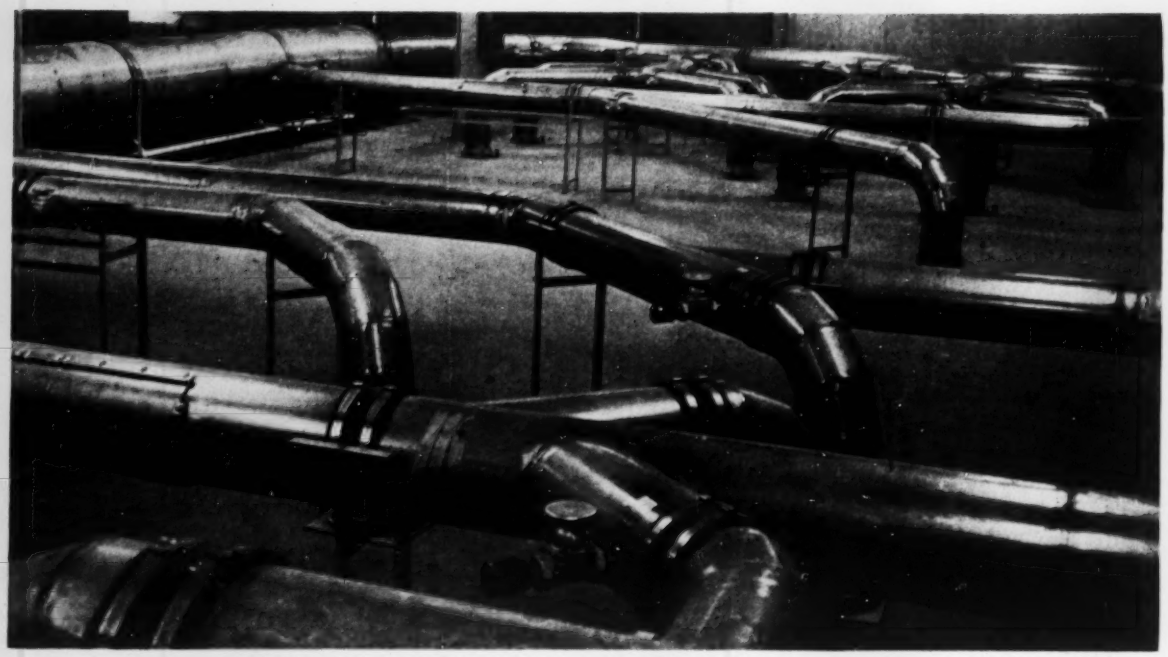
"Nose Is Best Smell Analyzer"

JOHN VON BERGEN, of Airkem, Inc., told a meeting of the Air Pollution Control Association in Baltimore about research into the mysteries of smell, his company's classification of some 4000 different odors, and the researchers' final conclusion that the most sensitive scientific instrument for detecting, identifying and analyzing odors is the human nose.

"When the man in the street says 'it stinks', that is a scientific statement of fact," he asserted. Not only do unpleasant odors depress property values, but they can also interfere with sleep and cause discomfort and nausea, even if they are non-toxic and otherwise harmless, he said.

Mr. Von Bergen discussed the way in which certain odors can counteract each other. When two odors are mixed in the correct proportions, the mixture of odors seems to have no effect whatsoever on the olfactory apparatus of the nose, and therefore the "smell" disappears, he stated. This can be done, he explained, without using any desensitizers.

Application of the counteractant principle to the control of industrial odors makes it economically possible for more industrial firms to maintain good will among property owners near their plants as well as to make better working conditions for employees.



THESE STAINLESS STEEL exhaust ducts serve laboratory rooms on floor below

Ventilation for Radioactive Work

Balancing · Operation · Maintenance

By W. W. McIntosh
Mechanical Engineer
General Electric Co.
Richland, Wash.

In buildings where radioactive materials are handled or processed, health and safety depend on proper functioning of the safeguards provided. The ventilation equipment and controls are most important safeguards; proper balancing of the ventilation system, and its subsequent operation and maintenance, therefore require considerable more than normal attention and effort

HEALTH AND SAFETY of personnel occupying buildings in which radioactive materials are processed or handled are dependent on proper functioning of the safeguards provided for their protection. These safeguards include shielding, remote manipulating devices, radiation detecting and measuring instruments, and means for controlling the movement of airborne radioactive particles and gases.

These provisions represent a very substantial investment, from which full return is expected. The usual business investment seldom involves risk of more than financial loss — but the loss of return on an investment in safety devices directly affects the welfare of operating personnel. Simple prudence dictates, then, that an investment in a protective ventilation system be insured by (1) proper initial installation and adjustment, and (2) a thoroughgoing maintenance and operation control program to preserve its original effectiveness.

The ventilation system for a building in which radioactive work is performed must be carefully designed and constructed to control the movement of air within the building and through its equipment. Successful fulfillment of this purpose is entirely dependent on proper adjustment of the air balance and of all control equipment. In addition to the need for adjusting air delivery quantities, temperatures and relative humidities, these protective systems require that the flow between rooms and zones be accurately adjusted and controlled — and that under all forseeable conditions of failure of components of the system the air movement will be such

AIR SAMPLING DEVICE (on right of branch duct) mounted on exhaust duct. Air for sampling for radioactivity is withdrawn from the exhaust duct through the piping connection, passed through a sampling filter at a predetermined rate, and discharged into the air sampling vacuum system main just below the main ventilation duct. The air volume control sensing device is a pitot tube mounted on the left side of the duct, connected to . . .

PITOT TUBE mounted in exhaust duct to measure and control quantity of exhaust from a laboratory room

. . . controller with tubing. Controller modulates a room bypass exhaust damper to maintain a constant quantity of exhaust, compensating for variable hood or equipment demand

that the safety of personnel is not jeopardized.

Many Instruments Needed

The personal preference and experience of the engineer will dictate the choice of specific types and makes of instruments used in ventilation balancing. For balancing controlled systems, a number of different measurements must be made:

1) Static pressure differentials from 15 to 0.01 in. WG.
2) Air velocities from 25 to 5000 fpm.
3) Temperatures from —20 to 120 F.
4) Relative humidities from 10 to 100 percent.
5) Electrical voltage and amperage.
6) Rpm of mechanical equipment.

The temperature, humidity, electrical and mechanical measurements offer no unusual problems. But the measurement of static pressures in the lower ranges, and the lower velocity measurements, are not normally required to be taken.

Inclined tube manometers are certainly most dependable devices for measuring static pressures, but are often cumbersome to use due to the need for setting-up and adjusting them each time a reading is taken in a new location. Mechanical type instruments are available for reading all but the lowest differential pressures, and are much more convenient in use. It is necessary to check this type of instrument periodically, however, to determine if calibration has been affected by bumping, jarring or other consequences of use.

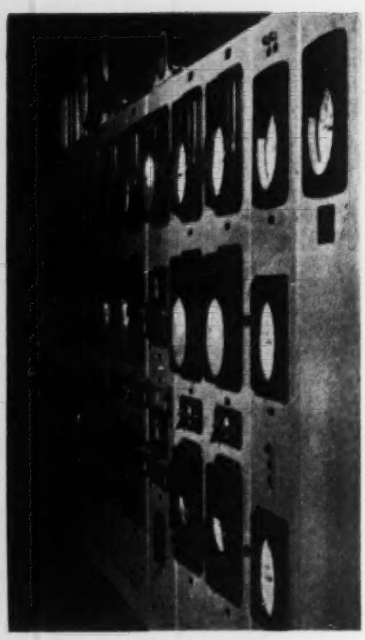
Velocity measurements can be made with a wide variety of instruments, ranging from the hot wire direct reading electrical type instrument to the old standby, the anemometer, used with a stop watch. Many of these instruments are quite effective and convenient within the ranges for which they are intended — but all have their limitations which are discovered by experience.

In a program in which air velocities must be accurately measured, it is necessary to make provisions for accurately calibrating the instruments and for frequently re-checking the calibrations. If this is not done, a great deal of difficulty may be experienced in attempting to obtain a semblance of ventilation balance using figures from instruments which may be giving erratic or inaccurate readings.

It is often convenient and necessary to know the direction and approximate velocity of air movement during balancing, without taking exact measurements. This can be accomplished by the old trick of hanging thin strips of tissue paper in doorways or openings, and by the use of smoke guns or generators. Smoke is especially useful in examining the air movement at doors and around hoods and other equipment during transient periods while doors are opened and closed, material is moved in or out, or fans are started and stopped.

How To Plan Balancing

Ventilation balancing is — by its nature — to a large extent a cut-and-try operation. A large number of variables can affect the balance — fan speed, initial fixed damper settings, cleanliness of the filters, ad-



VENTILATION SYSTEM CONTROL panel. Left portion of panel contains motor starters and indicating lights. Right portion is devoted to ventilation static pressure recorder-controllers, indicators, manual-automatic transfer switches and alarms. Temperature and humidity indicators and controllers are installed elsewhere

justment of the automatic dampers, or adjustment of control instruments for throttling range, speed of response and reset rate. Because of the number of adjustable variables, it is useful to take some time at the beginning of the job to plan the sequence in which adjustments will be made. In this way, an orderly and systematic method of doing the work may be evolved in which a minimum of re-doing it will be required.

The first requisite for a satisfactory balancing operation is complete authority over the use of the building. Absolute control of the opening and closing of all doors and windows and the use of all equipment which affects the ventilation system must be vested in the ventilation balancing group. This may require off-shift work by the balancers — but any extensive balancing operation is virtually impossible to perform while a building is in use.

Sequence of the Steps

The plans of action adopted for different buildings will vary widely with their design and layout. However, a general approach is applicable to most. A suggested sequence of steps is as follows:

1. Prepare in convenient form a complete diagrammatic arrangement of the ventilation system, showing all fans, ducts, manual and automatic dampers and other equipment. Designed air quantities, velocities and pressures should be indicated on the drawing, with room provided for noting measured values of these variables during balancing.

2. By inspection of the installation, select locations at which duct traverses can be accurately made — and indicate them on the diagrammatic.

3. With the use of the design calculations, determine the approximate preliminary settings for all manual dampers and splitters. Set them accordingly.

4. Adjust the fan drives for designed fan speeds.

5. Adjust supply and exhaust plenum pressures to design settings.

6. Open all doors within each isolated zone and close all outside and between-zone doors and air locks.

7. Immobilize automatic hood and equipment controls, and set hoods and equipment to designed average air inlet openings. Manually adjust automatic dampers to give designed face velocities through these openings.

8. Check main duct branches for air delivery by means of duct traverses. Adjust main branch dampers and splitters to designed quantities. In zone pressure control systems, the zone automatic control dampers may be manually adjusted to the desired zone pressures at the start. As the systems approach balanced adjustment, it should be possible to put these dampers under automatic control.

9. In systems utilizing constant quantity room exhaust control, it may be useful to place these controls in operation early in the balancing sequence to obtain the advantage of this self-adjusting feature.

10. Starting at the most remote terminal, adjust the supply and corresponding exhaust terminals, if practicable on each branch progressing up to its branch damper. This operation may be complicated or relatively simple depending on the relationship between the layouts of the supply and exhaust systems. If series flow is required between rooms, these adjustments must be made in such a manner that the desired direction and velocity of flow through doors and wall louvers are obtained.

11. Successive readjustments of terminal and branch dampers may be required before the first main branch is brought into balance, and further re-balance of the main branch dampers may be required before the remaining branches are balanced. But by systematizing the procedure and recording all data, this re-work can be held to a minimum.

12. When all manual dampers and splitters have been adjusted to give the required delivery and exhaust at all terminals, and the supply and exhaust systems are coordinated to give proper space-to-space flow through doorways and louvers, the automatic hood and equipment velocity control instruments can be adjusted.

13. When all equipment is operating in apparent adjustment, a final check of all terminals and main ducts should be made and a record of all velocities, quantities and static pressures should be made on the diagrammatic arrangement or in tabular form for the final ventilation balance. It is quite possible to obtain a balance of all air quantities to within a tolerance of plus or minus 10 to 15 percent of the design figures. It is essential that air flow between rooms be in the proper direction to at least the minimum design velocity and that velocity across the open faces of all hoods and equipment be within the design limits for all degrees of opening of the hood or equipment doors or shutters. It is not possible always to maintain designed air velocities during transient conditions while rapidly opening or closing doors; smoke checks will reveal such conditions and may be used as a basis for establishing operating procedures regarding permissible speed of operation of doors to prevent momentary vari-

ations of face velocity above or below acceptable levels.

14. The final step should consist of a careful examination of conditions under simulated failures of various types — such as exhaust fan failure, supply fan failure, normal power failure and total power failure. Air flow at all critical points (including the openings to all equipment and through all doorways and wall louvers) should be checked under these conditions and during the transients between normal operation and the failed condition. Similar checks should be made of normal start-up and shut-down procedures. It may be necessary to conduct these tests several times in order to observe all parts of the system under the test conditions. Tissue paper strips hung at doorways and smoke guns are very useful in making these air flow checks.

15. At the completion of the testing program, all damper quadrants should be secured with lock washers, pins or other means to prevent drifting due to vibration or other causes.

It is also useful to indelibly mark the position of all dampers, as finally set, for future reference.

Reading Pressures, Velocities

Short-cut methods are sometimes used in measuring air flow through ducts and supply or exhaust terminals. These methods are useful in taking preliminary readings, but cannot be relied on to yield the greater accuracy required in final balancing.

Locations for duct traverses should be carefully chosen, with a maximum length of straight duct without branches upstream of the measuring point. The duct readings should consist of the average of a number of individual readings taken in such a manner that each reading represents the velocity present in an equal area of the duct cross section. Terminal readings should be taken in the manner recommended by the terminal manufacturer and the maker of the measuring instrument.

Static pressures are especially difficult to obtain with accuracy. One of the most reliable methods is to use the static taps of a standard pitot tube. This eliminates the inaccuracies which are inherent with attempting to read static pressures at a hole in the duct wall.

For the adjustment of hood and equipment face velocity controls, zone pressure controls, plenum pressure controls and constant room exhaust controls, the assistance of the control manufacturers should be obtained. Their specialists are well qualified by knowledge and experience with their equipment to accomplish this work with the minimum expenditure of time and effort. Their services will also be found invaluable in instructing operating and maintenance personnel in the use and repair of controls.

From a review of this proposed procedure, it may well be concluded that the balancing job will require considerable more than normal effort. This is indeed the case; it has been found to take from two to as much as five times as long to balance these critical systems as to do an acceptable job with a conventional ventilation system.

Operation and Maintenance

The seriousness of the consequences of failure requires that an effective program of preventive maintenance be adopted for all portions of these ventilation systems.

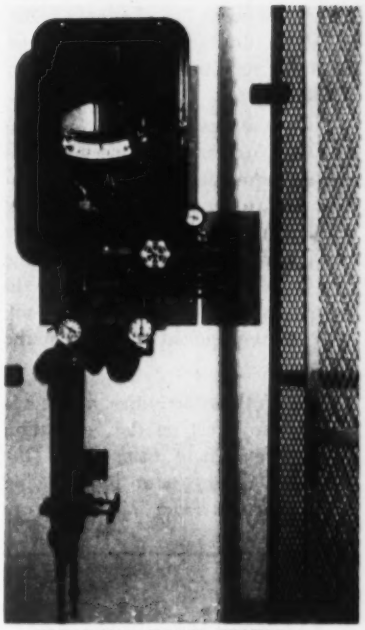
Regular inspection and overhaul schedules should be set up for fans, air washers, pumps, instruments, automatic dampers and all other equipment having moving parts.

Filters must be inspected and checked regularly for pressure drops and replacements must be made before the automatic control dampers have reached their limit of opening for compensating for filter loading.

In addition to these regular inspections, periodic tests should be made to determine the condition of safety devices which are required to function in emergency conditions.

These tests, duplicating the original testing of emergency operation, can be planned for off-shift periods and at times when disruption of operations in the building can be minimized.

In addition to the program of preventive maintenance for all operating parts, it has been found to be advisable to maintain — on a continuing basis — a constant surveillance of the entire facility for the two-fold purpose of (1) detecting deviations from required air flow patterns due to any cause, and (2) to observe all operations taking place in the building which may in any way affect the safe operation of the system.



BUILDING ZONE STATIC pressure sensing station, showing pneumatic transmitter. The expanded metal cage is provided for protection

The first function is carried out by conducting smoke gun or instrument checks of air movement in rooms, through doorways, louvers, terminals, ducts, and hood and equipment openings. These investigations, if carried out regularly, will promptly reveal failures of control equipment or loss of adjustment of manual or automatic dampers. This work should be diligently accomplished in such a manner that the entire system comes under surveillance with reasonable frequency. Experience will dictate the frequency, but unwise attempts to economize should not be permitted to interfere with this essential function.

Police Use of Ventilation

The second task is the delicate but necessary job of policing the use of the ventilation system and all equipment which depends on the system for the safeguarding of operating personnel.

Those who have had the responsibility for operating ventilation systems have probably contended with the problem of individuals who wish to make their own adjustments to

the system so as "to eliminate noise, cut down drafts, obtain better temperature conditions" or for other similar reasons.

There are also those in production who, as a matter of course, may disconnect equipment from its ventilation duct with or without blanking off the duct connection. They may also, when the need arises in the course of productive effort or to support a new experimental set-up, add new equipment or modify the old.

Any of these activities may have an adverse effect on the ventilation balance, and may compromise the safety of the operator by reducing his protection from airborne contamination in the new or revised equipment. Such alterations can usually be accommodated by the amply designed system — but compensating readjustments of a number of dampers or controls may be required to be made, since other parts of the system may be affected by the change. These readjustments should be made only under the direction of competent, fully informed supervision. This activity naturally fits in with the operating and maintenance responsibilities; thus, it is often practicable to combine these functions efficiently and effectively into one program carried out by one unit of the organization.

As a final check on the effectiveness of the ventilation system in accomplishing its purpose of controlling the spread of airborne contamination, a continuing program of radiation monitoring is carried out. This program includes routine checking of building interior spaces, including continuously taken air sampling within rooms, in ducts and at building discharge vents. In addition to these interior checks, constant monitoring of the surrounding area is carried out as a double-check on the efficiency of ventilation air effluent filtration.

[In the May HPAC, Mr. McIntosh wrote on the design of ventilation for radiological hazards. In June, he discussed the construction of ventilation systems for radioactive work.]

Climatic Factors Measure Air Conditioning Potentials

Here's a listing for each county in the U.S. of its degree-hour zone and its climatic factor, indicating its need for summer air conditioning and thus the potentials for marketing air conditioning and making summer cooling installations

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NATIONAL DISTRIBUTION of summer air conditioning products needs a set of base criteria which can be used to measure the effectiveness of distribution and plan marketing activities, it was pointed out in our article in the May HPAC.

Since people are prompted to purchase air conditioning systems for comfort by their own discomfort — both its *intensity* and *duration* — it is desirable to develop formulas for measuring those climatic factors which create discomfort.

As was described in May, weather data have been analyzed and summarized and climatic factors calculated based on weighting the duration of wet bulb temperatures of 66 F or higher as the greatest single factor in the measurement of discomfort. For instance, in Boston, the duration of wet bulb temperatures of 66 F and higher, in the four summer months, June through September, 24 hr per day, embraces 29.7 percent of the time. This duration weighted at 78.2 percent, design dry bulb temperature weighted at 8.3 percent, and design wet bulb temperature weighted at 13.5 percent develop an overall climatic factor which would indicate summer discomfort imposed by climate in Boston as about 35.6 percent as severe as the climatic discomfort of the state of Florida — the area of greatest summer discomfort in accordance with the studies.

The distribution of retail sales by states was used in Fig. 3 of the May article to indicate graphically the relative importance of the states as to their need for and capacity to purchase capital goods which, in turn, could be used to develop business.

Application of the climatic factors, as calculated, to the retail sales distribution by states makes it possible in Fig. 4 of the May article to develop a graphic portrayal of the market for commercial air conditioning for summer comfort in the United States.

Similarly, climatic factors developed by the use of degree day information for the various states makes it possible in Fig. 5 of the May article to show graphically the market for heating equipment in a relative way, using retail sales as the base.

In the May article, the degree-hour zones were shown on an outline map in Fig. 2 and the zones, with their climatic factors, were listed by states in Table 2. Table 3, the first part of which appeared in June and which is completed this month, gives these figures by individual counties.

M. K.—39—2

Code	County	Degree-Hour Zone	Climatic Factor
	NORTH CAROLINA — 32		
1	Alamance	2	.820
2	Alexander	1	.906
3	Alleghany	3	.782
4	Anson	2	.820
5	Ashe	3	.782
6	Avery	3	.782
7	Beaufort	1	.906
8	Bertie	1	.906
9	Bladen	1	.906
10	Brunswick	1	.906
11	Buncombe	3	.782
12	Burke	3	.782
13	Cabarrus	2	.820
14	Caldwell	3	.782
15	Camden	1	.906
16	Carteret	1	.906
17	Caswell	2	.820
18	Catawba	3	.782
19	Chatham	2	.820
20	Cherokee	3	.782
21	Chowan	1	.906
22	Clay	3	.782
23	Cleveland	3	.782
24	Columbus	1	.906
25	Craven	1	.906
26	Cumberland	2	.820
27	Currituck	1	.906
28	Dare	1	.906
29	Davidson	2	.820
30	Davie	3	.782
31	Duplin	1	.906
32	Durham	2	.820
33	Edgecombe	1	.906
34	Forsyth	3	.782
35	Franklin	2	.820
36	Gaston	3	.782
37	Gates	1	.906
38	Graham	3	.782
39	Granville	2	.820
40	Greene	1	.906
41	Guilford	2	.820
42	Halifax	2	.820
43	Harnett	2	.820
44	Haywood	3	.782
45	Henderson	3	.782
46	Hertford	1	.906
47	Hoke	2	.820
48	Hyde	1	.906
49	Iredell	3	.782
50	Jackson	3	.782
51	Johnston	2	.820
52	Jones	1	.906
53	Lee	2	.820
54	Lenoir	1	.906
55	Lincoln	3	.782
56	McDowell	3	.782
57	Macon	3	.782
58	Madison	3	.782
59	Martin	1	.906
60	Mecklenburg	2	.820
61	Mitchell	3	.782
62	Montgomery	2	.820
63	Moore	2	.820
64	Nash	2	.820
65	New Hanover	1	.906
66	Northampton	2	.820
67	Onslow	1	.906
68	Orange	2	.820
69	Pamlico	1	.906
70	Pasquotank	1	.906
71	Pender	1	.906
72	Perquimans	1	.906
73	Person	2	.820
74	Pitt	1	.906
75	Polk	3	.782
76	Randolph	2	.820
77	Richmond	2	.820
78	Robeson	1	.906
79	Rockingham	2	.820
80	Rowan	2	.820
81	Rutherford	3	.782
82	Sampson	1	.906
83	Scotland	2	.820
84	Stanly	2	.820
85	Stokes	3	.782
86	Surry	3	.782
87	Swain	3	.782
88	Transylvania	3	.782
89	Tyrrell	1	.906
90	Union	2	.820
91	Vance	2	.820
92	Wake	2	.820
93	Warren	2	.820
94	Washington	1	.906
95	Watauga	3	.782
96	Wayne	1	.906
97	Wilkes	3	.782
98	Wilson	2	.820
99	Yadkin	3	.782
100	Yancey	3	.782
	NORTH DAKOTA — 33		
—	All counties	1	.123
	OHIO — 34		
1	Adams	2	.638
2	Allen	1	.424
3	Ashland	1	.424
4	Ashtabula	1	.424
5	Athens	2	.638
6	Auglaize	1	.424
7	Belmont	1	.424
8	Brown	2	.638
9	Butler	2	.638
10	Carroll	1	.424
11	Champaign	1	.424
12	Clark	1	.424
13	Clermont	2	.638
14	Clinton	2	.638
15	Columbiana	1	.424
16	Coshocton	1	.424
17	Crawford	1	.424
18	Cuyahoga	1	.424
19	Darke	1	.424
20	Defiance	1	.424
21	Delaware	1	.424
22	Erie	1	.424
23	Fairfield	2	.638
24	Fayette	2	.638
25	Franklin	1	.424
26	Fulton	1	.424
27	Gallia	2	.638
28	Geauga	1	.424
29	Greene	2	.638
30	Guernsey	1	.424
31	Hamilton	2	.638
32	Hancock	1	.424
33	Hardin	1	.424
34	Harrison	1	.424
35	Henry	1	.424
36	Highland	2	.638
37	Hocking	2	.638
38	Holmes	1	.424
39	Huron	1	.424
40	Jackson	2	.638
41	Jefferson	1	.424
42	Knox	1	.424
43	Lake	1	.424
44	Lawrence	2	.638
45	Licking	1	.424
46	Logan	1	.424
47	Lorain	1	.424
48	Lucas	1	.424
49	Madison	1	.424
50	Mahoning	1	.424
51	Marion	1	.424
52	Medina	1	.424
53	Meigs	2	.638
54	Mercer	1	.424
55	Miami	1	.424
56	Monroe	1	.424
57	Montgomery	2	.638
58	Morgan	2	.638
59	Morrow	1	.424
60	Muskingum	1	.424
61	Noble	1	.424
62	Ottawa	1	.424
63	Paulding	1	.424
64	Perry	2	.638
65	Pickaway	2	.638
66	Pike	2	.638
67	Portage	1	.424
68	Preble	1	.424
69	Putnam	2	.638
70	Richland	1	.424
71	Ross	2	.638
72	Sandusky	1	.424
73	Scioto	2	.638
74	Seneca	1	.424
75	Shelby	1	.424
76	Stark	1	.424
77	Summit	1	.424
78	Trumbull	1	.424
79	Tuscarawas	1	.424
80	Union	1	.424
81	Van Wert	1	.424
82	Vinton	2	.638
83	Warren	2	.638
84	Washington	2	.638
85	Wayne	1	.424
86	Williams	1	.424
87	Wood	1	.424
88	Wyandot	1	.424
	OKLAHOMA — 35		
1	Adair	3	.836
2	Alfalfa	2	.656
3	Atoka	3	.836
4	Beaver	1	.565
5	Beckham	1	.565
6	Blaine	2	.656
7	Bryan	3	.836
8	Caddo	2	.656
9	Canadian	2	.656
10	Carter	3	.836
11	Cherokee	3	.836
12	Choctaw	3	.836
13	Cimarron	1	.565
14	Cleveland	2	.656
15	Coal	3	.836
16	Comanche	2	.656
17	Cotton	2	.656
18	Craig	2	.656
19	Creek	2	.656
20	Custer	1	.565
21	Delaware	3	.836
22	Dewey	1	.565
23	Ellis	1	.565
24	Garfield	2	.656
25	Garvin	2	.656
26	Grady	2	.656
27	Grant	2	.656
28	Greer	2	.656
29	Harmon	1	.565
30	Harper	1	.565
31	Haskell	3	.836
32	Hughes	3	.836
33	Jackson	2	.656
34	Jefferson	2	.656
35	Johnston	3	.836
36	Kay	2	.656
37	Kingfisher	2	.656
38	Kiowa	2	.656
39	Latimer	3	.836
40	Le Flore	3	.836
41	Lincoln	2	.656
42	Logan	2	.656
43	Love	3	.836
44	McClain	2	.656
45	McCurtain	3	.836
46	McIntosh	3	.836
47	Major	2	.656
48	Marshall	3	.836
49	Mayes	3	.836
50	Murray	3	.836
51	Muskogee	3	.836
52	Noble	2	.656
53	Nowata	2	.656
54	Okfuskee	3	.836
55	Oklahoma	2	.656
56	Okmulgee	3	.836
57	Osage	2	.656
58	Ottawa	3	.836
59	Pawnee	2	.656
60	Payne	2	.656
61	Pittsburg	3	.836
62	Pontotoc	3	.836
63	Pottawatomie	3	.836
64	Pushmataha	3	.836
65	Roger Mills	1	.565
66	Rogers	2	.656
67	Seminole	3	.836
68	Sequoyah	3	.836
69	Stephens	2	.656
70	Texas	1	.565
71	Tillman	2	.656
72	Tulsa	2	.656
73	Wagoner	3	.836
74	Washington	2	.656
75	Washita	2	.656
76	Woods	1	.565
77	Woodward	1	.565
	OREGON — 36		
1	Baker	1	.098
2	Benton	2	.124
3	Clackamas	2	.124
4	Clatsop	2	.124
5	Columbia	2	.124
6	Coos	2	.124
7	Crook	2	.124
8	Curry	2	.124
9	Deschutes	2	.124
10	Douglas	2	.124
11	Gilliam	2	.124
12	Grant	1	.098
13	Harney	1	.098
14	Hood River	2	.124
15	Jackson	2	.124
16	Jefferson	2	.124
17	Josephine	2	.124
18	Klamath	2	.124
19	Lake	2	.124
20	Lane	2	.124
21	Lincoln	2	.124
22	Linn	2	.124
23	Malheur	1	.098
24	Marion	2	.124
25	Morrow	1	.098
26	Multnomah	2	.124
27	Polk	2	.124
28	Sherman	2	.124
29	Tillamook	2	.124
30	Umatilla	1	.098
31	Union	1	.098
32	Wallowa	1	.098
33	Wasco	2	.124
34	Washington	2	.124
35	Wheeler	2	.124
36	Yamhill	2	.124
	PENNSYLVANIA — 37		
1	Adams	3	.547
2	Allegheny	2	.417
3	Armstrong	2	.417
4	Beaver	2	.417
5	Bedford	2	.417
6	Berks	3	.547
7	Blair	2	.417
8	Bradford	1	.310
9	Bucks	3	.547
10	Butler	2	.417
11	Cambria	2	.417
12	Cameron	2	.417

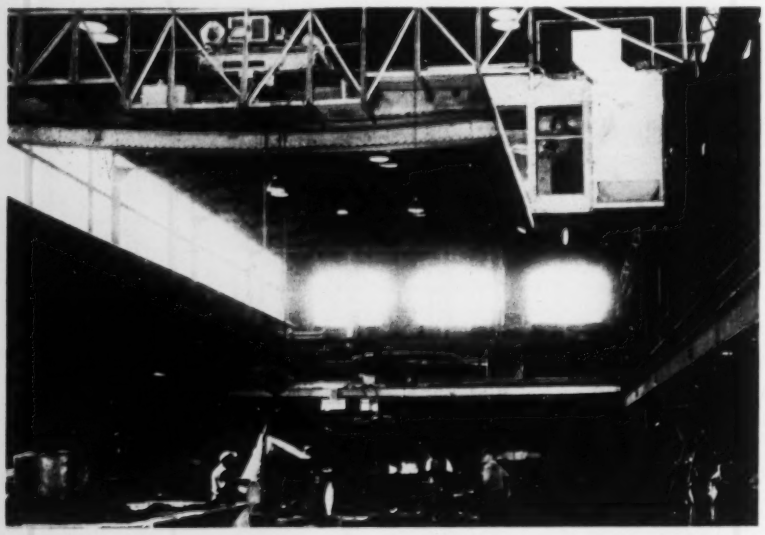
Code	County	Degree-Hour Zone	Climatic Factor
	Pennsylvania (continued)		
13	Carbon	3	.547
14	Centre	2	.417
15	Chester	3	.547
16	Clarion	2	.417
17	Clearfield	2	.417
18	Clinton	2	.417
19	Columbia	3	.547
20	Crawford	2	.417
21	Cumberland	3	.547
22	Dauphin	3	.547
23	Delaware	3	.547
24	Elk	2	.417
25	Erie	2	.417
26	Fayette	2	.417
27	Forest	2	.417
28	Franklin	3	.547
29	Fulton	2	.417
30	Greene	2	.417
31	Huntingdon	2	.417
32	Indiana	2	.417
33	Jefferson	2	.417
34	Juniata	3	.547
35	Lackawanna	3	.547
36	Lancaster	3	.547
37	Lawrence	2	.417
38	Lebanon	3	.547
39	Lehigh	3	.547
40	Luzerne	3	.547
41	Lycoming	3	.547
42	McKean	2	.417
43	Mercer	2	.417
44	Mifflin	3	.547
45	Monroe	3	.547
46	Montgomery	3	.547
47	Montour	3	.547
48	Northampton	3	.547
49	Northumberland	3	.547
50	Perry	3	.547
51	Philadelphia	3	.547
52	Pike	3	.547
53	Potter	2	.417
54	Schuylkill	3	.547
55	Snyder	3	.547
56	Somerset	2	.417
57	Sullivan	3	.547
58	Susquehanna	1	.310
59	Tioga	1	.310
60	Union	3	.547
61	Venango	2	.417
62	Warren	2	.417
63	Washington	2	.417
64	Wayne	1	.310
65	Westmoreland	2	.417
66	Wyoming	3	.547
67	York	3	.547
	RHODE ISLAND — 38		
—	All counties	1	.446
	SOUTH CAROLINA — 39		
1	Abbeville	1	.846
2	Aiken	1	.846
3	Allendale	2	.947
4	Anderson	1	.846
5	Bamberg	2	.947
6	Barnwell	2	.947
7	Beaufort	2	.947
8	Berkeley	2	.947
9	Calhoun	2	.947
10	Charleston	2	.947
11	Cherokee	1	.846
12	Chester	1	.846
13	Chesterfield	1	.846
14	Clarendon	2	.947
15	Colleton	2	.947
16	Darlington	1	.846
17	Dillon	2	.947
18	Dorchester	2	.947
19	Edgefield	1	.846
20	Fairfield	1	.846
21	Florence	2	.947
22	Georgetown	2	.947
23	Greenville	1	.846
24	Greenwood	1	.846
25	Hampton	2	.947
26	Horry	2	.947
27	Jasper	2	.947
28	Kershaw	1	.846
29	Lancaster	1	.846
30	Laurens	1	.846
31	Lee	1	.846
32	Lexington	1	.846
33	McCormick	1	.846
34	Marion	2	.947
35	Marlboro	1	.846
36	Newberry	1	.846
37	Oconee	1	.846
38	Orangeburg	2	.947
39	Pickens	1	.846
40	Richland	1	.846
41	Saluda	1	.846
42	Spartanburg	1	.846
43	Sumter	1	.846
44	Union	1	.846
45	Williamsburg	2	.947
46	York	1	.846

Code	County	Degree-Hour Zone	Climatic Factor
	SOUTH DAKOTA — 40		
1	Armstrong	2	.152
2	Aurora	3	.365
3	Beadle	1	.325
4	Bennett	2	.152
5	Bon Homme	3	.365
6	Brookings	3	.365
7	Brown	1	.325
8	Brule	1	.325
9	Buffalo	1	.325
10	Butte	2	.152
11	Campbell	2	.152
12	Charles Mix	3	.365
13	Clark	1	.325
14	Clay	3	.365
15	Codington	1	.325
16	Corson	2	.152
17	Custer	2	.152
18	Davison	3	.365
19	Day	1	.325
20	Deuel	1	.325
21	Dewey	2	.152
22	Douglas	3	.365
23	Edmunds	1	.325
24	Fall River	2	.152
25	Faulk	1	.325
26	Grant	1	.325
27	Gregory	3	.365
28	Haakon	2	.152
29	Hamlin	1	.325
30	Hand	1	.325
31	Hanson	3	.365
32	Harding	2	.152
33	Hughes	1	.325
34	Hutchinson	3	.365
35	Hyde	1	.325
36	Jackson	2	.152
37	Jerauld	3	.365
38	Jones	1	.325
39	Kingsbury	3	.365
40	Lake	3	.365
41	Lawrence	2	.152
42	Lincoln	3	.365
43	Lyman	1	.325
44	McCook	3	.365
45	McPherson	2	.152
46	Marshall	1	.325
47	Meade	2	.152
48	Mellette	1	.325
49	Miner	3	.365
50	Minnehaha	3	.365
51	Moody	3	.365
52	Pennington	2	.152
53	Perkins	2	.152
54	Potter	2	.152
55	Roberts	1	.325
56	Sanborn	3	.365
57	Shannon	2	.152
58	Spink	1	.325
59	Stanley	1	.325
60	Sully	1	.325
61	Todd	1	.325
62	Tripp	1	.325
63	Turner	3	.365
64	Union	3	.365
65	Walworth	2	.152
66	Washabaugh	2	.152
67	Washington	2	.152
68	Yankton	3	.365
69	Ziebach	2	.152
	TENNESSEE — 41		
1	Anderson	1	.783
2	Bedford	2	.851
3	Benton	2	.851
4	Bledsoe	1	.783
5	Blount	1	.783
6	Bradley	1	.783
7	Campbell	1	.783
8	Cannon	2	.851
9	Carroll	2	.851
10	Carter	1	.783
11	Cheatham	2	.851
12	Chester	2	.851
13	Claiborne	1	.783
14	Clay	1	.783
15	Cocke	1	.783
16	Coffee	2	.851
17	Crockett	2	.851
18	Cumberland	1	.783
19	Davidson	2	.851
20	Decatur	2	.851
21	De Kalb	1	.783
22	Dickson	2	.851
23	Dyer	2	.851
24	Fayette	2	.851
25	Fentress	1	.783
26	Franklin	2	.851
27	Gibson	2	.851
28	Giles	2	.851
29	Grainger	1	.783
30	Greene	1	.783
31	Grundy	1	.783
32	Hamblen	1	.783
33	Hamilton	1	.783
34	Hancock	1	.783
35	Hardeman	2	.851
36	Hardin	2	.851

Code	County	Degree-Hour Zone	Climatic Factor
37	Hawkins	1	.783
38	Haywood	2	.851
39	Henderson	2	.851
40	Henry	2	.851
41	Hickman	2	.851
42	Houston	2	.851
43	Humphreys	2	.851
44	Jackson	1	.783
45	Jefferson	1	.783
46	Johnson	1	.783
47	Knox	1	.783
48	Lake	2	.851
49	Lauderdale	2	.851
50	Lawrence	2	.851
51	Lewis	2	.851
52	Lincoln	2	.851
53	Loudon	1	.783
54	McMinn	1	.783
55	McNairy	2	.851
56	Macon	2	.851
57	Madison	2	.851
58	Marion	1	.783
59	Marshall	2	.851
60	Maury	2	.851
61	Meigs	1	.783
62	Monroe	1	.783
63	Montgomery	2	.851
64	Moore	2	.851
65	Morgan	1	.783
66	Obion	2	.851
67	Overton	1	.783
68	Perry	2	.851
69	Pickett	1	.783
70	Polk	1	.783
71	Putnam	1	.783
72	Rhea	1	.783
73	Roane	1	.783
74	Robertson	2	.851
75	Rutherford	2	.851
76	Scott	1	.783
77	Sequatchie	1	.783
78	Sevier	1	.783
79	Shelby	2	.851
80	Smith	2	.851
81	Stewart	2	.851
82	Sullivan	1	.783
83	Sumner	2	.851
84	Tipton	2	.851
85	Trousdale	2	.851
86	Unicoi	1	.783
87	Union	1	.783
88	Van Buren	1	.783
89	Warren	1	.783
90	Washington	1	.783
91	Wayne	2	.851
92	Weakley	2	.851
93	White	1	.783
94	Williamson	2	.851
95	Wilson	2	.851
	TEXAS — 42		
1	Anderson	5	.984
2	Andrews	2	.414
3	Angelina	5	.984
4	Aransas	5	.984
5	Archer	3	.655
6	Armstrong	2	.414
7	Atascosa	4	.946
8	Austin	5	.984
9	Bailey	2	.414
10	Bandera	4	.946
11	Bastrop	4	.946
12	Baylor	3	.655
13	Bee	4	.946
14	Bell	4	.946
15	Bexar	4	.946
16	Blanco	4	.946
17	Borden	2	.414
18	Bosque	4	.946
19	Bowie	5	.984
20	Brazoria	5	.984
21	Brazos	5	.984
22	Brewster	2	.414
23	Briscoe	2	.414
24	Brooks	5	.984
25	Brown	3	.655
26	Burleson	4	.946
27	Burnet	4	.946
28	Caldwell	4	.946
29	Calhoun	5	.984
30	Callahan	3	.655
31	Cameron	7	1.015
32	Camp	5	.984
33	Carson	2	.414
34	Cass	5	.984
35	Castro	2	.414
36	Chambers	5	.984
37	Cherokee	5	.984
38	Childress	2	.414
39	Clay	3	.655
40	Cochran	2	.414
41	Coke	3	.655
42	Coleman	3	.655
43	Collin	4	.946
44	Collingsworth	2	.414
45	Colorado	5	.984
46	Comal	4	.946
47	Comanche	3	.655
48	Concho	3	.655

Code	County	Degree-Hour Zone	Climatic Factor
	Texas (continued)		
49	Cooke	4	.946
50	Coryell	4	.946
51	Cottle	2	.414
52	Crane	2	.414
53	Crockett	3	.655
54	Crosby	2	.414
55	Culberson	1	.335
56	Dallam	2	.414
57	Dallas	4	.946
58	Dawson	2	.414
59	Deaf Smith	2	.414
60	Delta	5	.984
61	Denton	4	.946
62	De Witt	4	.946
63	Dickens	2	.414
64	Dimmit	4	.946
65	Donley	2	.414
66	Duval	4	.946
67	Eastland	3	.655
68	Ector	2	.414
69	Edwards	4	.946
70	Ellis	4	.946
71	El Paso	1	.335
72	Erath	3	.655
73	Falls	4	.946
74	Fannin	4	.946
75	Fayette	4	.946
76	Fisher	2	.414
77	Floyd	2	.414
78	Foard	3	.655
79	Fort Bend	5	.984
80	Franklin	5	.984
81	Freestone	4	.946
82	Frio	4	.946
83	Gaines	2	.414
84	Galveston	6	1.013
85	Garza	2	.414
86	Gillespie	4	.946
87	Glasscock	2	.414
88	Goliad	4	.946
89	Gonzales	4	.946
90	Gray	2	.414
91	Grayson	4	.946
92	Gregg	5	.984
93	Grimes	5	.984
94	Guadalupe	4	.946
95	Hale	2	.414
96	Hall	2	.414
97	Hamilton	4	.946
98	Hansford	2	.414
99	Hardeman	3	.655
100	Hardin	5	.984
101	Harris	5	.984
102	Harrison	5	.984
103	Hartley	2	.414
104	Haskell	3	.655
105	Hays	5	.984
106	Hemphill	2	.414
107	Henderson	5	.984
108	Hidalgo	5	.984
109	Hill	5	.984
110	Hockley	2	.414
111	Hood	5	.984
112	Hopkins	5	.984
113	Houston	5	.984
114	Howard	2	.414
115	Hudspeth	1	.335
116	Hunt	4	.946
117	Hutchinson	2	.414
118	Irion	3	.655
119	Jack	3	.655
120	Jackson	5	.984
121	Jasper	5	.984
122	Jeff Davis	2	.414
123	Jefferson	5	.984
124	Jim Hogg	5	.984
125	Jim Wells	5	.984
126	Johnson	4	.946
127	Jones	3	.655
128	Karnes	4	.946
129	Kaufman	4	.946
130	Kendall	4	.946
131	Kenedy	5	.984
132	Kent	2	.414
133	Kerr	4	.946
134	Kimble	3	.655
135	King	2	.414
136	Kinney	4	.946
137	Kleberg	5	.984
138	Knox	3	.655
139	Lamar	5	.984
140	Lamb	2	.414
141	Lampasas	4	.946
142	La Salle	4	.946
143	Lavaca	4	.946
144	Lee	4	.946
145	Leon	5	.984
146	Liberty	5	.984
147	Limestone	4	.946
148	Lipscomb	2	.414
149	Live Oak	4	.946
150	Llano	5	.655
151	Loving	2	.414
152	Lubbock	2	.414
153	Lynn	2	.414
154	McCulloch	3	.655
155	McLennan	4	.946
156	McMullen	4	.946
157	Madison	5	.984
158	Marion	5	.984
159	Martin	2	.414
160	Mason	3	.655
161	Matagorda	5	.984
162	Maverick	4	.946
163	Medina	4	.946
164	Menard	3	.655
165	Midland	2	.414
166	Milam	4	.946
167	Mills	3	.655
168	Mitchell	2	.414
169	Montague	4	.946
170	Montgomery	5	.984
171	Moore	2	.414
172	Morris	5	.984
173	Motley	2	.414
174	Nacogdoches	5	.984
175	Navarro	4	.946
176	Newton	5	.984
177	Nolan	2	.414
178	Nueces	5	.984
179	Ochiltree	2	.414
180	Oldham	2	.414
181	Orange	5	.984
182	Palo Pinto	3	.655
183	Panola	5	.984
184	Parker	4	.946
185	Parmer	2	.414
186	Pecos	2	.414
187	Polk	5	.984
188	Potter	2	.414
189	Presidio	2	.414
190	Rains	5	.984
191	Randall	2	.414
192	Reagan	2	.414
193	Real	4	.946
194	Red River	5	.984
195	Reeves	2	.414
196	Refugio	5	.984
197	Roberts	2	.414
198	Robertson	4	.946
199	Rockwall	4	.946
200	Runnels	3	.655
201	Rusk	5	.984
202	Sabine	5	.984
203	San Augustine	5	.984
204	San Jacinto	5	.984
205	San Patricio	5	.984
206	San Saba	3	.655
207	Schleicher	3	.655
208	Scurry	4	.946
209	Shackelford	3	.655
210	Shelby	5	.984
211	Sherman	2	.414
212	Smith	5	.984
213	Somervell	4	.946
214	Starr	5	.984
215	Stephens	3	.655
216	Sterling	2	.414
217	Stonewall	2	.414
218	Sutton	3	.655
219	Swisher	2	.414
220	Tarrant	4	.946
221	Taylor	3	.655
222	Terrell	3	.655
223	Terry	2	.414
224	Throckmorton	3	.655
225	Titus	5	.984
226	Tom Green	3	.655
227	Travis	4	.946
228	Trinity	5	.984
229	Tyler	5	.984
230	Upshur	5	.984
231	Upton	2	.414
232	Uvalde	4	.946
233	Val Verde	4	.946
234	Van Zandt	5	.984
235	Victoria	5	.984
236	Walker	5	.984
237	Waller	5	.984
238	Ward	2	.414
239	Washington	5	.984
240	Webb	4	.946
241	Wharton	5	.984
242	Wheeler	2	.414
243	Wichita	4	.946
244	Wilbarger	3	.655
245	Willacy	5	.984
246	Williamson	4	.946
247	Wilson	4	.946
248	Winkler	2	.414
249	Wise	4	.946
250	Wood	5	.984
251	Yoakum	2	.414
252	Young	3	.655
253	Zapata	4	.946
254	Zavala	4	.946
	UTAH — 43		
1	Beaver	1	.074
2	Box Elder	1	.074
3	Cache	1	.074
4	Carbon	1	.074
5	Daggett	1	.074
6	Davis	1	.074
7	Duchesne	1	.074
8	Emery	1	.074
9	Garfield	1	.074
10	Grand	1	.074
11	Iron	1	.074
12	Juab	1	.074
13	Kane	1	.074
14	Millard	1	.074
15	Morgan	1	.074
16	Piute	1	.074
17	Rich	1	.074
18	Salt Lake	2	.084
19	San Juan	1	.074
20	Sanpete	1	.074
21	Sevier	1	.074
22	Summit	1	.074
23	Tooele	1	.074
24	Uintah	1	.074
25	Utah	1	.074
26	Wasatch	1	.074
27	Washington	1	.074
28	Wayne	1	.074
29	Weber	1	.074
	VERMONT — 44		
—	All counties	1	.140
	VIRGINIA — 45		
1	Accomac	1	.906
2	Albermarle	2	.820
3	Alleghany	3	.785
4	Amelia	2	.820
5	Amherst	3	.785
6	Appomattox	2	.820
7	Arlington	2	.820
8	Augusta	3	.785
9	Bath	3	.785
10	Bedford	3	.785
11	Bland	3	.785
12	Botetourt	3	.785
13	Brunswick	2	.820
14	Buchanan	3	.785
15	Buckingham	2	.820
16	Campbell	2	.820
17	Caroline	1	.906
18	Carroll	3	.785
19	Charles City	1	.906
20	Charlotte	2	.820
21	Chesterfield	2	.820
22	Clarke	2	.820
23	Craig	3	.785
24	Culpepper	2	.820
25	Cumberland	2	.820
26	Dickenson	3	.785
27	Dinwiddie	2	.820
28	Elizabeth City	1	.906
29	Essex	1	.906
30	Fairfax	2	.820
31	Fauquier	2	.820
32	Floyd	3	.785
33	Fluvanna	2	.820
34	Franklin	3	.785
35	Frederick	2	.820
36	Giles	3	.785
37	Gloucester	1	.906
38	Goochland	2	.820
39	Grayson	3	.785
40	Greene	2	.820
41	Greensville	1	.906
42	Halifax	2	.820
43	Hanover	2	.820
44	Henrico	2	.820
45	Henry	3	.785
46	Highland	3	.785
47	Isle of Wight	1	.906
48	James City	1	.906
49	King and Queen	1	.906
50	King George	1	.906
51	King William	1	.906
52	Lancaster	1	.906
53	Lee	3	.785
54	Loudoun	2	.820
55	Louisa	2	.820
56	Lunenburg	2	.820
57	Madison	2	.820
58	Mathews	1	.906
59	Mecklenburg	2	.820
60	Middlesex	1	.906
61	Montgomery	3	.785
62	Nansemond	1	.906
63	Nelson	3	.785
64	New Kent	1	.906
65	Norfolk	1	.906
66	Northampton	1	.906
67	Northumberland	1	.906
68	Nottoway	2	.820
69	Orange	2	.820
70	Page	2	.820
71	Patrick	3	.785
72	Pittsylvania	2	.820
73	Powhatan	2	.820
74	Prince Edward	2	.820
75	Prince George	1	.906
76	Prince William	2	.820
77	Princess Anne	1	.906
78	Pulaski	3	.785
79	Rappahannock	2	.820
80	Richmond	1	.906
81	Roanoke	3	.785
82	Rockbridge	3	.785
83	Rockingham	2	.820

Code	County	Degree-Hour Zone	Climatic Factor
	Virginia (continued)		
84	Russell	3	.783
85	Scott	3	.783
86	Shenandoah	2	.820
87	Smyth	3	.783
88	Southampton	1	.906
89	Spotsylvania	2	.820
90	Stafford	2	.820
91	Surry	1	.906
92	Sussex	1	.906
93	Tazewell	3	.783
94	Warren	2	.820
95	Warwick	1	.906
96	Washington	3	.783
97	Westmoreland	1	.906
98	Wise	3	.783
99	Wythe	3	.783
100	York	1	.906
	WASHINGTON — 46		
1	Adams	2	.076
2	Asotin	2	.076
3	Benton	1	.098
4	Chelan	1	.098
5	Clallam	1	.098
6	Clark	1	.098
7	Columbia	2	.076
8	Cowlitz	1	.098
9	Douglas	1	.098
10	Ferry	2	.076
11	Franklin	2	.076
12	Garfield	2	.076
13	Grant	1	.098
14	Grays Harbor	1	.098
15	Island	1	.098
16	Jefferson	1	.098
17	King	1	.098
18	Kitsap	1	.098
19	Kittitas	1	.098
20	Klickitat	1	.098
21	Lewis	1	.098
22	Lincoln	2	.076
23	Mason	1	.098
24	Okanogan	1	.098
25	Pacific	1	.098
26	Pend Oreille	2	.076
27	Pierce	1	.098
28	San Juan	1	.098
29	Skagit	1	.098
30	Skamania	1	.098
31	Snohomish	1	.098
32	Spokane	2	.076
33	Stevens	2	.076
34	Thurston	1	.098
35	Wahkiakum	1	.098
36	Walla Walla	2	.076
37	Whatcom	1	.098
38	Whitman	2	.076
39	Yakima	1	.098
	WEST VIRGINIA — 47		
—	All counties	1	.717
	WISCONSIN — 48		
1	Adams	1	.524
2	Ashland	1	.524
3	Barron	1	.524
4	Bayfield	1	.524
5	Brown	1	.524
6	Buffalo	2	.458
7	Burnett	1	.524
8	Calumet	1	.524
9	Chippewa	1	.524
10	Clark	1	.524
11	Columbia	1	.524
12	Crawford	2	.458
13	Dane	2	.458
14	Dodge	1	.524
15	Door	1	.524
16	Douglas	1	.524
17	Dunn	1	.524
18	Eau Claire	1	.524
19	Florence	1	.524
20	Fond du Lac	1	.524
21	Forest	1	.524
22	Grant	2	.458
23	Green	2	.458
24	Green Lake	1	.524
25	Iowa	2	.458
26	Iron	1	.524
27	Jackson	2	.458
28	Jefferson	1	.524
29	Juneau	1	.524
30	Kenosha	1	.524
31	Kewaunee	1	.524
32	La Crosse	2	.458
33	Lafayette	2	.458
34	Langlade	1	.524
35	Lincoln	1	.524
36	Manitowoc	1	.524
37	Marathon	1	.524
38	Marinette	1	.524
39	Marquette	1	.524
40	Milwaukee	1	.524
41	Monroe	2	.458
42	Oconto	1	.524
43	Oneida	1	.524
44	Outagamie	1	.524
45	Ozaukee	1	.524
46	Pepin	2	.458
47	Pierce	2	.458
48	Polk	1	.524
49	Portage	1	.524
50	Price	1	.524
51	Racine	1	.524
52	Richland	2	.458
53	Rock	2	.458
54	Rusk	1	.524
55	St. Croix	1	.524
56	Sauk	2	.458
57	Sawyer	1	.524
58	Shawano	1	.524
59	Sheboygan	1	.524
60	Taylor	1	.524
61	Trempealeau	2	.458
62	Vernon	2	.458
63	Vilas	1	.524
64	Walworth	2	.458
65	Washburn	1	.524
66	Washington	1	.524
67	Waukesha	1	.524
68	Waupaca	1	.524
69	Waushara	1	.524
70	Winnebago	1	.524
71	Wood	1	.524
	WYOMING — 49		
—	All counties	1	.078



Foundry Crane Operators Get Clean Air

CONTINUOUS OPERATION at full capacity in a foundry building at Greenlee Bros. & Co., Rockford, Ill. — with fumes arising from core setting operations, burning residual oil from molds, and drying out flasks and ladles — caused the crane operators to ask for relief after a few hours of duty. Natural ventilation in the building carried the fumes up away from the working floor and out the open windows, but the crane operators were directly in this path. Consequently, they were constantly enveloped in the cloud of irritating fumes and odors, which made the job unpleasant and annoying.

Making a thorough investigation of the problem from a ventilation standpoint, the management decided the best and most practical solution was corrective measures for each of the three crane cabs involved. These consisted of enclosing each cab with safety glass on the sides and $\frac{1}{8}$ in. thick transparent plastic on the front, sloping it outward and upward to provide an unobstructed view of the pouring floor, and installing a cab air conditioner. These units — complete with dust filter, activated carbon fume adsorbers and electric strip heaters — clean the air and provide heat for winter. Thus each operator works in a clean and comfortable atmosphere.

Proof of the value of the cab conditioners came soon after they were installed. To get a rush order out in the allotted time required that the entire foundry floor be pressed into service for continuous pouring operations. The fumes were so dense that it would have been absolutely impossible to meet the time limit without the crane cab conditioners. [Photo courtesy Dravo Corp.]

Compromise Instead of Liens?

FAR BE IT FROM ME to suggest a course contrary to that of good fellowship. . . . "Cooperation" is *not* cooperation, however, when the price you pay is a waiver of your legal rights. In the following case (the names are camouflaged) legal advice before good-natured compliance would have saved the heating contractors much money and their day in court.

Flaim & Frost, a partnership in the heating contracting business, contracted with the Wellwurth Construction Corp. to furnish and install heating equipment for a certain project. When they consulted the Hesperian State Bank as to Wellwurth's credit and responsibility, the president of that institution said: "We don't see what you have to worry about, because we're going to finance that undertaking. We'll see to it that the bills are paid, for we can't afford to have liens."

Relying upon this statement, Flaim & Frost took the contract and furnished materials and labor.

The bank subsequently loaned Wellwurth a certain sum per unit for construction of the project. A substantial portion of the loan funds, Flaim & Frost stated in court, was used with the bank's consent "for purposes other than the construction of these units".

When Flaim & Frost learned what was going on, they called a pre-court conference of Wellwurth's creditors. At that conference, the heating contractors informed Wellwurth and the bank that they were going to file liens, the time limit having not yet expired. Thereupon, the bank — through its vice president — persuaded Flaim & Frost not to file by making the following alleged "false statements, representations and promises."

a) The bank and Wellwurth would "make every effort to pay" the heating firm.

b) The bank would "handle" the creditors.

c) The profits from two affiliated projects would pay all bills of the particular project for which Flaim & Frost had furnished the heating.

d) If the heating contractors or others filed any liens, Wellwurth would go into bankruptcy and the heating men would get nothing.

e) If, on the other hand, no liens were filed, Wellwurth would give certain notes to Flaim & Frost and convey to that partnership certain buildings which would bring a profit.

Flaim & Frost accepted the proffered notes, together with title to certain buildings. One of these, the contractors testified, sold at less than they had taken it at and the notes proved uncollectible. Four months after receiving the first notes and buildings, Flaim & Frost were induced to accept another similar set of notes and buildings — with similarly sad results.

Consequently, Flaim & Frost sued the Hesperian State Bank, alleging in a cross-complaint that the financial institution had by false representations induced them to furnish materials and labor. They asked that their liens be put ahead of the bank's mortgages, that the bank furnish an accounting, and that they be awarded damages of some $15,000.

In reply, the financial institution invoked the legal principle that a false representation, to be the basis of a suit, must relate to a past or present existing fact. The bank's attorneys further argued that a representation "must be for the purpose of inducing action" and that Flaim & Frost had not alleged injury from specific mis-representation. Their very failure to file liens was used as an argument against them: "They had opportunity to protect themselves by their own acts and they do not show any injury from failure to file their liens."

Supporting a general contention that the bank was not liable, its attorneys pointed out that one of the heating partners, though claiming to be a "customer" of the bank, did not enjoy any "fiduciary relationship" with it, and that the other partner was not even a depositor.

The district court rendered judgment against the heating contractors, dismissing their complaints and sustaining the bank's "demurrers".

Though the state supreme court on appeal reversed part of the lower court's decision and ordered a new trial, it upheld the bank in contending that the heating contractors had no claim against it in respect to the buildings taken in part payment on their contract. They had helped to construct those buildings, reasoned the court, and were in as good position as the bank to know their worth.

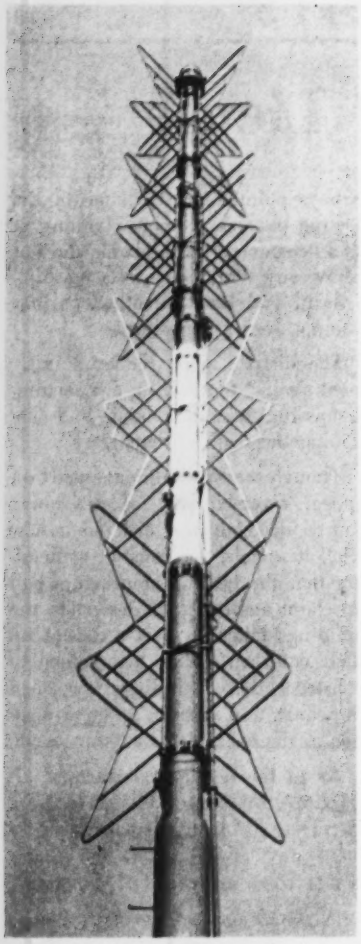
As to the heating contractors' allegations that the bank gave false certification to the federal government on the property, the higher tribunal saw no cause of action.

One of the supreme court judges held — in a dissenting opinion — that the lower court's judgment against the heating men should have been fully affirmed. Said he in part, ". . . it appears that four months after the promises were made" by the bank, Flaim & Frost "were 'induced and persuaded' to give credit for additional" buildings and "promissory notes" of Wellwurth Construction Corp. "(whose credit they knew was not good.) Thus, they dealt with the party to whom they furnished the materials and labor, on the apparent theory of settling their claims."

They "accepted assets . . . from which the builders might otherwise have received a greater return, and caused the builders and the bank to change their position . . . By so doing" the heating contractors "have waived any cause of action they may have had for any fraud previously practiced upon them."

[Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

William Hurd Hillyer, author of this article, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.



Sound Control Poses Problems

. . . . when air conditioning a television station. How they've been handled on actual installations is discussed here

By F. F. Stevenson

SOUND ATTENUATION poses many problems in television station air conditioning work. The noise level in most installations is taken as 20 decibels or less, but this level is sometimes exceeded.

Fans Represent Chief Source of Noise

In any air distributing system, the fans represent the chief source of noise. Much of the sound is of low frequency, which is the most difficult to suppress.

The air conditioning designer has a choice of two kinds of centrifugal fans, the forwardly curved and the backwardly curved blade, non-overloading type. There is some controversy about the respective quietness of these fans and their application in air conditioning work. The forwardly curved fan operates at a lower rpm and tip speed for a given outlet velocity. It is usually belt driven, and large, slow speed fans of this type sometimes must use an 1150 rpm motor in order to bring the drive ratio to a suitable figure.

The non-overloading fan has a higher rpm and tip speed and sometimes is directly connected to the motor, which effects a saving in cost. This may not always be an asset, however, because with a belt driven fan, various adjustments may be made in the drive after the system is installed to change the speed and air volume of the fan.

With a higher tip speed, the low frequency mechanical noise of the non-overloading fan is greater than that of the forwardly curved. With the same outlet velocity, the air rush noise across the cut-off sections should be about the same for each type. This is a high frequency noise, which is fairly easy to suppress in the run of duct.

Makers of backwardly curved blade fans contend, however, that this type of fan, operating fairly close to its maximum efficiency point, is not any noisier than the forwardly curved. So the air conditioning designer can take his choice.

I used non-overloading fans on one television installation, principally because the owner's engineer favored them. The fans are operated close to their high efficiency points and are not overly noisy. In another case, the same type of fan is used in a two fan plenum installation — that is, one supply fan with the resistance of the plenum equipment on the intake side and that of the supply duct on its discharge side, and one recirculating fan with the resistance of the return duct on its intake side and practically no resistance on its discharge side. Handling a large volume of air against a small static pressure, the latter fan operates considerably to the right of its maximum efficiency point and is noisier than it should be. A forwardly curved fan installation here would cost more,

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because a slow speed motor is required.

Low Frequency and High Frequency Noise

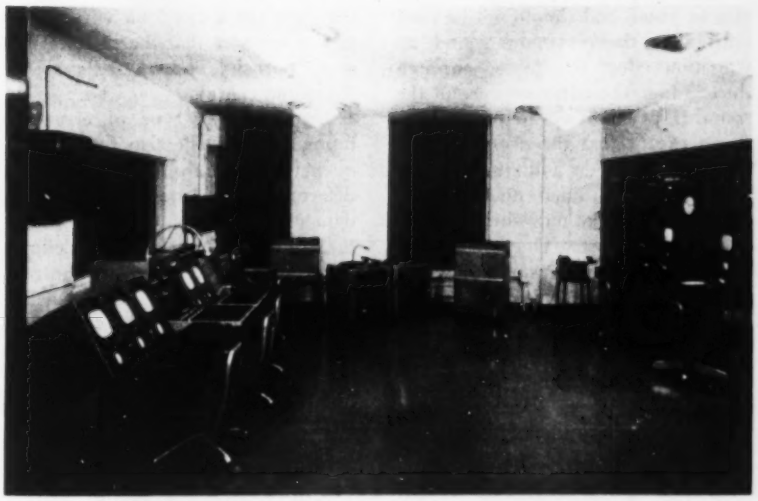
Many fan manufacturers will not give complete noise ratings for their fans and they can hardly be blamed for this because there are so many variables in the reference point at which a rating is determined. In the design of the above-mentioned installation, the fan noise level was taken as 75 db — this was probably not very far off. With the noise level assumption made the next question is, How much in low frequency, say 256 cycles per second, and how much in high frequency, 1024 cycles? (The absorption qualities of acoustical materials are much different for low and high frequencies.) This is an item of information that is apparently not generally available — at least I found this so — and the designer is invited to take a good running guess. The high speed non-overloading fan will probably have a greater proportion of low frequency noise than the forwardly curved fan.

It is therefore suggested that in planning the suppression of fan noise, the premise be made that all noise is at low frequency and an acoustical treatment of the ducts capable of suppressing the low frequency will surely take care of the high frequency.

Another noise phenomenon which should be noted is that low frequency noise at moderate intensities is much less audible to the human ear than is a high frequency noise of the same intensity. Therefore, in average air conditioning work it is not necessary to reduce sounds at around 250 cycles as much as sounds at about 1000 cycles or so. In television and broadcasting work, however, the engineers will tell you their apparatus will pick up noise at all frequencies and will not favor one over another. I suspect that this is not strictly accurate, but as I am not a television authority, I suggest the statement be taken as is.

Must Treat Ducts Acoustically

Therefore, starting with a noise level of 75 db, the air conditioning designer must apply acoustical treatment to the duct work between the fan and the air outlet to reduce this level by, say, 80 percent. In addition, this treatment must suppress all air rush noises generated in the fan and equipment plenum caused by coils, filters and the like, plus any other noise generated in the duct work itself by obstructions. These latter noises are high frequency and if the acoustical treatment is designed to kill the 75 db low frequency noise at the fan, it will also take care of them.



A TELEVISION control room. (Both photos courtesy NBC)

The noise generated at the ceiling diffuser, plaque or grille at the air outlet is a horse of another color. It cannot be suppressed by treating the duct, although as sound waves radiate in all directions, a small portion of it will be absorbed if the duct lining is carried on to the very end of the run. However, credit is not generally taken for this and the full rating of the outlet fixture should be used in the acoustical calculations.

We must therefore select a fixture with a noise level so that when its sound intensity is added to the sound level of the room with the ventilating system off, the resulting intensity will be within the total noise level specified. With this value taken as 20 db and when the studio, with the air conditioning equipment off, registers a level of 17 db, the noise rating of the outlet fixture must be 17 db or less. If the acoustical treatment of the duct work is not adequate to suppress all of the fan and plenum noise and there is a residual noise, of say, 5 db left in the duct, then the noise rating of the fixture would have to be lower — about 15 db.

Acoustical Treatment for One Job

For the acoustical treatment of the duct work at one TV station, a sound absorbing liner was used with a number of sound traps, which are sections of lined duct equipped with lined splitters or partitions, dividing the duct into two or more channels. The splitters are simply for the purpose of getting a greater area of acoustical treatment per linear foot of duct run. All elbows were furnished with acoustically lined turning vanes.

The acoustical material used was a glass fiber bonded with resin. It is flexible, easily cut, has good sound absorbing qualities, and is not hard on the installer's hands. It has the approval of the Underwriters and can be used in large structures, where the employment of non-approved material would raise the insurance rates. The liner weighs 3 lb per cu ft. It should be coated on one side or have a smooth facing in order to reduce air flow resistance. If insurance rates are a factor, the coating or facing must be fireproof also.

The liner is 1 in. thick and was applied with a cold adhesive directly to the sheet metal — or it may be mechanically fastened by sheet metal screws and washers.

When laying out lined ducts, the designer should locate good-sized access doors at frequent intervals.

The sound traps are quite expen-

sive to install and should not be used until after the maximum sound attenuation effect is attained through duct lining. The extra expense of the sound traps might not be particularly great, except that the acoustical lining also serves as a thermal insulation — so the lined duct sections require no insulation, which affords a saving in cost. Of course, this would not be true in installations having ducts running exposed in the air conditioned space which would not require thermal insulation.

Partition Strips for Shallow Ducts

When ducts are shallow, the splitters or partition strips should be run horizontal and parallel with the air flow. It may be easier to install the strips vertically, but in shallow ducts a much greater length would be required for a given sound absorbing requirement.

The splitters may be fabricated of light sheet metal lined on both sides with the acoustical material and mechanically attached to the inside of the duct. Another method is to use a different type of glass fiber applied to a rigid asphaltic base. This eliminates the need of separate sheet metal sections and the labor of applying the liner to them.

At 256 cycles, the sound absorbing coefficients of glass fiber and rigid mineral board are about the same, but at 1024 cycles, the coefficient of glass fiber is higher. It should be noted that the tables of sound coefficients shown in most literature give values effective when the absorbing material is mounted in accordance with specifications assuming that the liner has rigidity and is attached to the sides of the duct by means of furring strips on 24 in. centers. Such a mounting affords an entirely different sound absorbing quality than that attained by fastening the material directly on the sheet metal with an adhesive. With the first method, the energy of the sound waves causes the furred acoustical sections to vibrate and the work of vibration expends the energy, wholly or in part. If the material is porous — that is, containing a multiplicity of air cells — the sound waves flow into the air cells, cannot get out and expend their energy in heating up the air within the cells. In other words, each cell forms a tiny sound trap. The second method of mounting does not depend on vibration at all; it assumes that the material has great porosity and air cells absorb the sound energy.

The vibrating type of acoustical lining is most effective for low frequency sound absorption, so when determining a coefficient for the dampening of low frequency noise, the kind of mounting should definitely be known. When using the non-vibrating mounting, I believe the coefficients shown in the average tables should be reduced by about 20 percent. For high frequency attenuation, the type of mounting makes little difference.

Sound Treatment for Commentator's Room

In another television installation, there is a commentator's room having a sound level with the system off of 15 db and a total requirement of 18 db. The air supply volume is high, amounting to about 30 air changes per hr. The room is small, with a moderate ceiling height and a content of 1200 cu ft. It is acoustically treated as follows:

Ceiling — Acoustical pan, perforated type, with two 1 in. layers of glass wool, absorption coefficient at 256 cycles, 0.58.

Walls — 3/16 in. perforated asbestos board and 2 in. of glass fiber, mounted on furring strips, with a ½ in. air space between, coefficient at 256 cycles, 0.57.

Floor — Linoleum laid on a pad, coefficient at 256 cycles, 0.05.

There is one occupant during normal operation, who was credited with 4 sound absorbing units (which included an upholstered chair.) The reverberation time requirement was taken to be 0.5 second. The number of sound absorbing units required was computed by Sabine's formula,

$$a = (0.05 \times V)/t$$

where a = number of sound absorbing units; V = volume of space, cu ft; t = reverberation time, seconds; 0.05 = empirical factor.

Then, we have,

$$a = (0.05 \times 1200)/0.5$$
$$= 60/0.5 = 120$$

Therefore, the room must have at least 120 sound absorbing units to meet the reverberation time requirement.

Here's a recapitulation of the sound absorbing units:

Ceiling: 120 sq ft × 0.58	69.5 units
Walls: 155 sq ft × 0.57	89.0 units
Floor: 120 sq ft × 0.05	6.0 units
Occupant and chair	4.0 units
Total	168.5 units

Therefore, the acoustical treatment of the room is more than adequate.

Supply air is introduced into the room by a six-cone ceiling diffuser, selected for its high aspirating potential and having a noise rating of about 15 db. This diffuser gives excellent results, there are no drafts (notwithstanding the high air volume) and its sound emission is well within that specified.

The blower fan is quite close to the room and has a noise rating of 75 db. The room in question is only one part of a large system, with the fan handling more than 20,000 cfm.

To suppress this noise in the run of duct between the fan and the commentator's room, we used 40 ft of unlined sheet metal duct, which included five large elbows and six medium elbows; and 30 ft of lined sheet metal duct, with sound cells dividing the duct into three channels, and two elbows.

The duct size is 20x16 in.; it was impossible, due to space limitations, to achieve a higher aspect ratio. In order to gain length, the ducts were not run straight, but in a circular fashion, which accounts for the large number of elbows.

Calculating the Sound Absorbing Potential

The calculation of the sound absorbing potential of the duct run is as follows:

Unlined Ductwork — The attenuation of sound in unlined sheet metal ducts was assumed to be 1 db per 100 ft of length; attenuation of medium elbows, 1.5 db each; and of large elbows, 1 db (all at 256 cycles per second.) Therefore:

0.40	× 1.0	0.4 db
6	× 1.5	9.0 db
5	× 1.0	5.0 db
Total		14.4 db

Lined section — In the computation of the sound absorption in the lined section of duct run, the coefficient of the lining material, 3 lb glass fiber, was taken as 0.43 and the elbows were given an attenuation of 2.5 db each, (each at 256 cycles).

The formula for sound reduction in acoustically lined ducts is:

$$R = 12.6\ L\ (P/A)\ a^{1.4}$$

where R = sound reduction, decibels; L = length of duct run, ft; P = perimeter of duct, in.; A = cross section of duct, sq in.; and a = sound absorption coefficient.

With a value of 0.43 given to a, the equation may be simplified to:

$$R = 3.8\ L\ (P/A)$$
$$R = 3.8 \times 30 \times (72/320)$$
$$R = 25.6 \text{ db}$$

Knowing the noise reduction due to lining, the further reduction due

to the lined splitter arrangement may be computed by:

$$R_T = R_L \times (A + BN)/(A + B)$$

where R_T = total noise reduction, decibels; R_L = reduction due to lining only; A = dimension, short side of duct, in.; B = dimension, long side of duct, in.; and N = number of channels formed by splitters.

Then we have:

$R_T = 25.6\ [16 + (20 \times 3)]/(16 + 20)$
$= 25.6 \times 2.11 = 54.0$ db

Reduction in lined elbows:

$3 \times 2.5 = 7.5$ db

Recapitulation:

Noise reduction in unlined duct section	14.4 db
Noise reduction in lined duct section	54.0 db
Noise reduction in elbows of lined section	7.5 db
Total noise reduction	75.9 db

As stated previously, this reduction is for low frequency noise (256 cycles or thereabouts.) There is additional high frequency air rush noise in the system (around 1024 cycles) caused by plenum equipment and in the duct work. However, as part of the fan noise is at high frequency (instead of all at 256 cycles) and knowing that the coefficient of the lining material is almost twice as great at 1024 cycles as at 256 cycles, the air rush noise was neglected and the fan and duct noise was assumed to be 100 percent suppressed. The correctness of this assumption was confirmed after the system was in operation.

For a space with a noise level of 15 db with the system off and having a ceiling diffuser with a rating of 15 db, the total level would be computed as follows:

Noise level of room = 15 db or 1.5 bels
Noise level of diffuser = 15 db or 1.5 bels
Noise intensity ratio = Antilog of noise rating in bels
Total noise intensity ratio = Sum of each intensity ratio

Then,

Antilog 1.5 = 31.6

and,

Total noise intensity ratio = 31.6 + 31.6 = 63.2

Log 63.2 = 1.8 bels or 18 db

The total noise rating of the room is therefore 18 decibels. The return air duct from this room was treated similarly to the supply duct and the return air intakes sized liberally.

[Mr. Stevenson's next article on air conditioning TV stations will discuss air distribution. His article in the May HPAC was devoted to heat loads and design temperatures.]

Atlanta Biltmore Hotel Air Conditions 250 Rooms

WILLIAM H. CHAMBERS, vice president, explains operation of one of the room units to Mrs. Helen B. Eddy, executive housekeeper. Room units are supplied with conditioned air through conduits, as well as chilled water for cooling or hot water for heating through piping in same shaft as conduit

THE ATLANTA BILTMORE hotel now boasts of 250 air conditioned rooms in addition to the air conditioned lobby, mezzanine and executive offices, dining rooms, and all meeting rooms. The exhibition hall was air conditioned last summer.

The Biltmore has been in the process since last summer of having the air conditioning equipment installed — and with no interruption in the use of the guest rooms.

It all started last August when the hotel booked guests into one wing while workmen progressively moved through the other, sliding small diameter conduits and piping from the roof down through vertical tiers of rooms. The conduits carry conditioned air while the pipes carry chilled water for cooling in the summer and hot water for heating in the winter. In December when the individual room units arrived, they were installed in the guest rooms.

A 315 ton absorption refrigerating machine chills the water. It is located on the roof.

A small 16 in. by 21 in. column in the corner of each guest room conceals the ductwork and piping, was treated architecturally and decoratively in keeping with the design of each room.

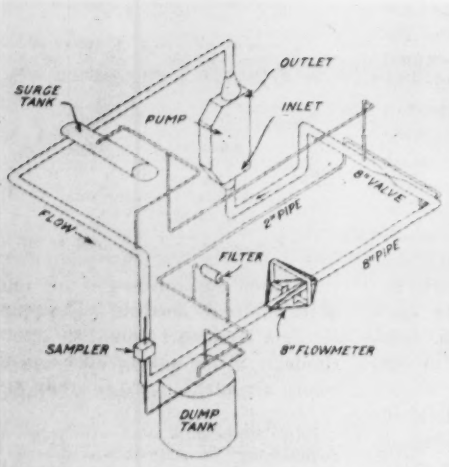
The hotel plans to extend air conditioning to additional rooms until the refrigerating machine is utilized to its capacity (400 rooms.)

The cost of air conditioning ran to $3.10 per sq ft. The Sockwell Co. was the mechanical contractor.

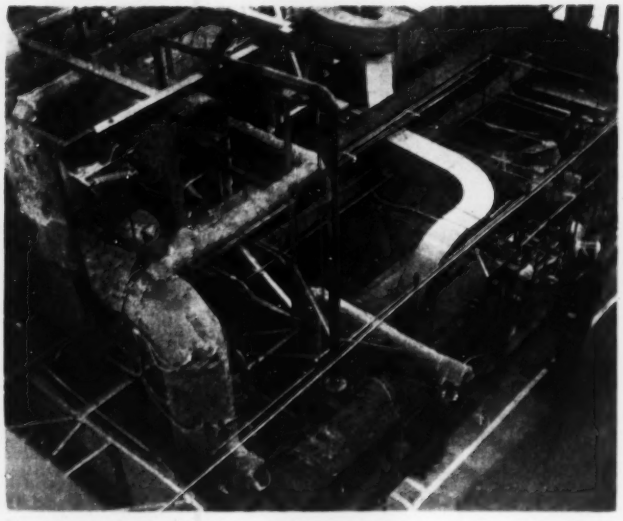
The hotel's air conditioning program was initiated due to the increased number of requests for air conditioned rooms as well as the desire to offer the most modern and up-to-date facilities to guests.

The management believes hotels will find it necessary to have more air conditioned rooms due to the great public acceptance and demand for air conditioning.

The air conditioning program is publicized by special mailings to former guests. Also an announcement was made by means of a special enclosure mailed with all correspondence from the hotel (reservation confirmations, monthly statements, remittances to purveyors and all other mailings.) Also, all the hotel's literature is overprinted with an announcement of the air conditioning.



AN 8 IN. STAINLESS STEEL PIPE loop is used. Electric heaters maintain the temperature



SPRING HANGERS support the piping as it expands and contracts. The piping is insulated with mineral wool blankets

Piping Liquid Metal

At the Knolls Atomic Power Laboratory, liquid sodium is circulated by an electromagnetic pump through 8 in. stainless steel piping

LIQUID SODIUM — a metallic element — is being pumped through a piping system in an experimental installation at the Knolls Atomic Power Laboratory, which is operated by the General Electric Co. for the Atomic Energy Commission. The set-up is used for testing an electromagnetic pump and magnetic flow meter, the closed circuit pipe loop being employed to study pump performance and obtain performance curves by computing pressure versus flow with various voltages, pressures and sodium temperatures.

Flow is measured by the magnetic flow meter in gallons per minute, with an accuracy within 2 percent. The temperature varies according to the test performed, and ranges from 580 to as high as 1000 F. Sodium melts at 210 F and boils at 1616 F. The pressure ranges from 0 to 75 delta pressure, the difference between the inlet and outlet pressures.

Eight inch pipe is used for the main circulating system with 4 in. pipe for the bypass line, 2 in. drain lines, and 1 in. pipe and ½ in. tubing for pressure measurement. All sodium loop and helium blanket system piping is stainless steel.

The 8 in. piping is suspended by spring hangers. A flexible constant load hanger is needed to support the pipe as it expands and contracts, as rigidly fastened pipe could cause undue stresses and strains. The piping and the pump are insulated with mineral wool blankets.

The 4 in. bypass line is used to increase pressure drop, as part of the testing procedure.

Electric Heaters for Sodium

The piping is heated before and during operation by nicrome heating wire and tubular heaters.

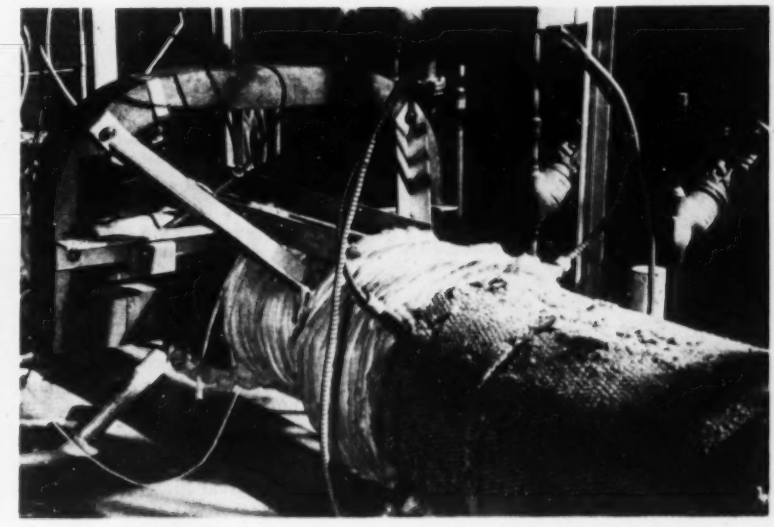
The sodium in the dump tank is melted and brought to the desired temperature by strip heaters and tubular heaters.

The nicrome wire is used on all the 4, 2 and ½ in. piping because it is easy to bend. It is also used on all valves. The tubular heaters are used on the 8 in. pipe. Temperature is controlled automatically from a main control which is set prior to the running of a test; changes can be made, however, during operation. Thermocouples set in wells on the 8 in. pipe take the temperature and relay it to the heat control unit on the control panel.

Bellows seal valves are used. It is necessary in sodium work (and all liquid metal work) to prevent leakage around packing glands. The valves were specifically designed for liquid metal work.

Longitudinal fins are welded on sections of the 8 in. pipe and are

THE THREE-PHASE ELECTRO-MAGNETIC PUMP, performance of which is studied by varying voltages, pressures, temperatures



A MAGNETIC FLOW METER measures the flow in gallons per minute, with an accuracy within 2 percent

BELLOWS SEAL VALVES are used. In liquid metal work, leakage around packing glands must be prevented

CONTROL AND INSTRUMENT PANEL for the electromagnetic pump and piping set-up

covered with sheet metal ducts. By this process, heat can be taken out of the pipes, to thermocycle the pump — that is, "shock" the pump to lower temperatures.

When the pump is not in operation, the system is filled with an inert atmosphere of helium to exclude all air. In operation, a blanket of helium is spread over all parts of the system not filled with sodium to prevent oxidation. Oxidized sodium forms a solid and might clog the smaller diameter piping.

As a constant safeguard all sodium is forced through a micro-metallic filter to remove dirt, impurities and other solid particles. A sampler is used to measure the oxygen content of the sodium.

The sodium is kept in a dump tank which holds 350 gal. When operation starts, the sodium is forced out of the tank under helium pressure. The helium is bled off as the sodium fills the system. The surge tank serves to indicate when the system is filled. The unfilled portion of the surge tank is blanketed with helium.

The Control Panel

The control panel serves the following purposes:

1) Shows temperature of various sections of piping and pump.

2) Controls temperature of piping and pump.

3) Has instrumentation for measuring flow and pressure.

4) Has controls for varying pump pressures.

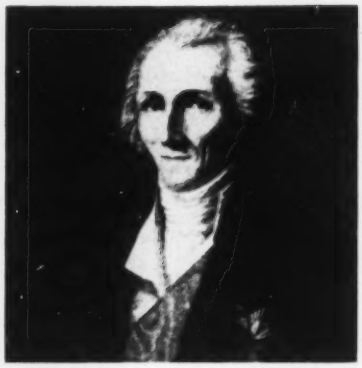
5) Has gages for measuring helium pressure and the necessary controls.

6) Has controls for measuring heat on system manually or automatically.

7) Incorporates an alarm system for indicating pump failure. Water coolant is used on the pump itself, and should there be a cooling failure the pump is automatically shut down.

By Willard Allphin

Count Rumford — Heating Engineer



TWO HUNDRED YEARS AGO the man later to be created Count Rumford was born in Woburn, Mass. His success formula was unusual in that, having been born a farmer's son in the New World, he achieved his fame in the Old World.

It would require at least an entire issue of HPAC to review his accomplishments in science, in military reforms and in sociology; but his investigations and inventions in the heating field are of the greatest interest to the readers of these columns.

From the 30 papers Count Rumford wrote on heat, he is probably best known [as was pointed out in a biographical account by Prof. Sanborn C. Brown, published by the American Academy of Arts and Sciences, Boston, in 1950] for "his intensive attacks on the caloric theory. He was one of the first successful advocates of the energy theory of heat. He carried out a large number of experiments to refute the various caloric arguments.

" 'Useful improvements. . . to promote the good of mankind' were fully as significant to Count Rumford as 'important discovery'. In the field of heat he wrote nine papers concerning practical applications of his theoretical studies. Having discovered the existence of convection currents, he designed the modern fireplace, with the smoke shelf, the throat, and the sloping back and bevelled walls to project the heat into the room. He designed cooking stoves from which the modern kitchen range is directly descended. He introduced ovens for roasting, a pressure cooker, the modern double boiler, and the use of steam heat for heating rooms. He was always proud of the fact that he never patented any of his inventions, but published detailed descriptions for all to copy."

Most of Rumford's published work deals with careful experimentation and measurement at every stage of a project. However, he was capable of building a strong structure of logic simply by reasoning from facts available to everyone. In this vein he is probably at his best in a paper entitled Of the Salubrity of Warm Rooms, written in about 1800. It might almost have been written today, from what we hear of the heating methods of our British cousins. Perhaps the only flaw in the paper is his touching faith that once he has explained the matter logically, the English people [or any people] will mend their ways.

"Of the Salubrity of Warm Rooms"

His paper begins by pointing out that rooms heated by fireplaces are unhealthy not only because the heat is applied to one side of the body but because large quantities of cold air are continually drawn in to replace the air which is going up the chimneys. He says:

"It is universally allowed to be very dangerous to be exposed in a stream of cold air, especially when standing or sitting still; but how much must the danger be increased if one side of the body be heated by the powerful rays from a large fire, while the other is chilled by these cold blasts? And there is this singular circumstance attending these chills, that they frequently produce their mischievous effects without our being sensible of them; for, as the mind is incapable of attending to more than one sensation at one and the same time, if the *intensity* of the sensation produced by the heat on the one side of the body be superior to that of the cold on the other, we shall remain perfectly insensible of the cold, however severe it may really be; and if we are induced by the disagreeableness of what we do feel to turn about, or change our position or situation, this movement will be occasioned not by the cold, which we do not feel, but by the heat, which being superior in its effect upon us engages all our attention. And hence we may account for those severe colds or catarrhs which are so frequently gotten in hot rooms in this country by persons who are not conscious at the time of being exposed to any cold, but on the contrary, suffer great and continual inconvenience from the heat."

Cold Walls and Cold Drafts

He then describes the effect of cold walls in producing convection currents and adding cold drafts to those coming from outdoors. He adds:

"I never see a delicate young lady dressed in thin muslins or gauzes, in the midst of winter, expose herself in such a perilous situation, without shuddering for the consequences. But how many young persons of both sexes do we find of delicate habits, and particularly among the higher ranks of society? And what vast numbers are carried off annually by consumptions?

"Much has been said of the supposed danger of keeping rooms warm in winter, on account of the necessity most people are under of sometimes going into the cold air. But how many proofs are there that these sudden transitions from heat to cold, or from cold to heat, are not attended with danger, if care be taken to be properly clothed, and if the heats and colds are not partial?

"How very hot do the Swedes and the Russians keep their houses during the long and severe frosts that prevail in winter in those countries!

Mr. Allphin is engaged in illumination research with Sylvania Electric Products, Inc.

And yet no people are more strong and healthy than they are, nor are there any less liable to catarrhs and consumptions."

The "Genial Warmth" of 60 Degrees Fahrenheit

In discussing the heating of German houses and the lack of injurious effects in going from heated rooms into cold air, Rumford reveals a different scale of values than prevails today, for he speaks of "the genial warmth of 60 or 65 degrees Fahrenheit."

After further examples involving Swedes, Laplanders and Russians, their good health at home and their discomfort and disorders when visiting England, he continues: "It has often been objected to warm rooms, that the air in them is always confined, and consequently unwholesome; but no argument more perfectly groundless and nugatory [trifling] was ever adduced in support of a bad cause.

"When in cold weather a room is kept warm, the air in it, so far from being confined, is continually changing. Being specifically lighter, in consequence of its being warm, than the air without, it is impossible to open and shut a door without vast quantities of it being forced out of the room by the colder air from without, which rushes in; and if at any time it be required to ventilate the room in so complete a manner that not a particle of the air in it shall remain in it, this may be done in less time than one minute, merely by letting down the top of one of the windows, and at the same time opening a door which will admit the external colder and heavier air. And it must not be imagined that the room will be much cooled in consequence of this complete ventilation.

"The *walls of the room* would still be nearly as warm as before, and the radiant heat from those walls, passing through the transparent air of the room without any sensible diminution of their calorific powers, would produce the same sensation of warmth as they did before."

Use and Enjoy Our Power Over Fire

In conclusion, Rumford says: "If man has been less kindly used than brute animals, by being sent naked into the world without a garment to cover and defend from the inclemency of the seasons, the power which has been given him over *fire* has made the most ample amends for that natural deficiency; and it would be wise in us to derive all possible advantages from the exercise of the high prerogative we enjoy."

[The portrait of Count Rumford is from the collection of Prof. Sanborn C. Brown, Massachusetts Institute of Technology. The quotations from Count Rumford are taken from the American Academy of Arts and Sciences' works of Count Rumford published in 1875.]

WELDING THE STEEL pipe for the radiant heating coils at one of the schools. (Photo courtesy Spang-Chalfant Div., National Supply Co.)

Combined Radiant, Forced Air Systems Heat Schools

A COMBINATION of radiant heating and forced air heating serves two new elementary schools at New Milford, N. J., a rapidly-growing community near New York City. Each is a one story, basementless structure with 14 classrooms accommodating 30 children per room.

Hot water, circulated through radiant heating coils in concrete slabs, is controlled to furnish a room temperature up to 55 F. Additional heat is furnished by forced air. This combination is reported to make the heating system flexible, permitting rapid compensation for sudden changes in outside temperature. On warm days, the blowers can be used to circulate air.

Steel pipe is used for the radiant heating systems at both schools. In each, 9700 ft of 1 in. standard black pipe is used to form the coils. The supply and return mains use 890 ft of 1¼ in. pipe and 265 ft of 1½ in. pipe.

Grady and Meyer, Teaneck, N. J., are the engineers, and Fred Wendell, Oradel, N. J., is the heating contractor.

New Boiler To Relieve Boiler Plant in Summer

A COMPLETELY AUTOMATIC boiler, situated in the engine room, will permit shutting down the present boiler plant in summer at the American La France-Foamite Corp., Elmira, N. Y., according to The Babcock & Wilcox Co.

The new boiler — a shop-assembled, compact unit — will be tied in with the existing high pressure steam system for producing process steam during the heavy-load winter months. In the summer it will operate alone to furnish the minimum process steam required for running the plant.

As the boiler is operated by push-button start and stop, the engineer can supervise it, leaving firemen free for productive work or for supplementing maintenance crews.

"Formerly a large portion of the fuel burned during the summer, averaging about 50 tons per week, was used for banking and actually served no useful purpose," the plant's engineer explains. "The new boiler will not require banking, as it will burn only enough fuel to maintain pressure during periods of low loads." Variations in steam load are also handled by automatic controls. The new boiler will produce 8000 lb per hr of steam and is oil and gas fired.

A new motor-driven air compressor will also be installed at this plant to eliminate the use of a steam-driven compressor during the summer months.

General Sarnoff Hopes for Electronic Conditioner

IN AN ADDRESS BEFORE this year's annual banquet of the Institute of Radio Engineers, David Sarnoff, chairman of the board of the Radio Corp. of America, reported that "an all-electronic air conditioner is still in the embryonic stage" at the RCA laboratories "but I saw signs of life."

Among the inventions he had asked the staff to make to mark his 50th radio anniversary in 1956, General Sarnoff had listed an electronic air conditioner with no moving parts.

Wrong Piping, Operation Add To "Implosion" Hazards

Some of the causes of failure of vessels subject to external pressure

THE WORD "implosion" is not in common usage, but it signifies a hazard common to many pressure vessels -- a bursting inward, the opposite of *explosion*. With pressure vessels, the implosion hazard arises when external surfaces are subjected to a higher pressure than internal surfaces. The pressure load then tends to crush or collapse the vessel.

All parts of a vessel may be subject to a collapsing load. For example, all parts of the shell and heads of a single-walled vacuum tank are subject to a higher pressure externally (atmospheric pressure) than internally. And the collapsing load will depend upon the *net effective pressure*, or difference between pressure of the atmosphere and absolute pressure within the vessel.

In other instances, only part of a vessel is subject to external pressure. Most double-walled, or jacketed vessels, fall in this class. A positive pressure, usually steam pressure, in the jacket or space between the two walls, imposes a force external with respect to the inner wall of the vessel. This force tends to crush or collapse the inner shell. At the same time, the jacket pressure subjects the outer shell to stresses which tend to burst it outwardly. So the vessel is exposed simultaneously to the hazards of implosion and explosion.

In many instances the results of a collapse are not spectacular because the accident does not usually involve any great outward thrusting force to damage equipment surrounding the vessel and level building walls. In relatively few cases is the vessel projected from its foundation or torn apart in such a way as to cause damage by flying pieces.

This information has been excerpted, by special permission, from a more extensive article in The Locomotive, published by The Hartford Steam Boiler Inspection and Insurance Co.

Can Be Costly

Damage by implosion or collapse, even though confined to the vessel and its contents, can be costly. With process vessels, the contents are often of high value and their loss alone can be a sizeable item. Many vessels, particularly jacketed types, are expensive to construct or repair. Others are fabricated of costly materials, or are designed with expensive corrosion resistant linings. And, in addition to loss from physical damage, the accident is likely to result in production losses.

Principal Causes

The principal causes of implosion or collapse of vessels subject to external pressure are:

1) Vessels weakened by erosion, corrosion, etc.

2) Pressure in jackets too high for the design.

3) Excessive vacuum in vessels designed for low vacuum.

4) Vacuum developing in vessels built for internal pressure only.

Failure of Vacuum Breaker

Failure of protective devices can lead to collapse. Some single-walled vessels that usually operate under internal pressure may at times be subjected to vacuum conditions. They are equipped with safety valves to relieve internal pressure and, since many of them are not built to withstand full vacuum, they are also equipped with vacuum breakers. Acting as safety valves in reverse, the vacuum breakers admit air to the vessel to protect it from the effects of excessive external pressure. And, just as the failure of a safety valve can lead to an explosion, so can failure of a vacuum breaker lead to an implosion or collapse.

In a recent case, a thin walled drier roll used in a textile mill collapsed due to failure of a vacuum breaker. This drier operated normally under low steam pressure, but at certain times vacuum would develop. And since the roll was not built for full vacuum, it was equipped with a vacuum breaker as well as a safety valve. The accident happened when the breaker became stuck, permitting an excessively high vacuum.

Rapid Vacuum Increase

In some instances vessels equipped with vacuum breakers collapse from excessive external pressure in spite of the fact that the breakers are in good working order. Vacuum may develop so rapidly under some conditions that the breaker cannot admit air to the vessel fast enough to relieve the vacuum as rapidly as it is propagated. The ordinary breaker will handle a relatively slow increase in vacuum such as will occur from draining the contents of the vessel, or from the use of a vacuum pump, or from condensation of vapor in the vessel by a gradual drop in temperature. But when the vapor is condensed almost instantaneously by introduction of cold liquid, the breaker may be inadequate to handle the rapid drop in pressure.

A vacuum breaker in good working order failed to prevent the collapse of a 10 ft diameter distilling column in a recent accident. The vessel was being steam cleaned and when this job was completed, the operator, instead of permitting the steam to condense gradually, turned cold rinse water into the vessel. Steam in the vessel condensed so rapidly, and the pressure drop was so fast, that the breaker could not relieve the situation. One head and a section of the shell collapsed.

Double-Walled Vessels

Although nature places a limit (atmospheric pressure) on the force

that acts externally upon a single-walled vessel, no such fixed limit applies in the case of double-walled vessels. Pressure between the two walls, tending to crush the inner wall, is generated artificially and is limited only by the means used to generate the pressure — a boiler, for example — and its control. This difference in the source of external pressure is of great importance in the relative hazards of single-walled and double-walled vessels.

In the great majority of jacketed vessels, a positive steam pressure is used in the jacket. However, the contents space or innermost chamber of the vessel may be: (1) open to the atmosphere, (2) closed and under pressure, (3) closed and under vacuum. It will be recognized that pressure conditions in the contents space, as well as in the jacket space, have a bearing on the net effective pressure tending to crush the inner shell, and both pressures must be taken into account in calculating the required strength of the inner shell to resist collapse.

Failures of jacketed vessels by collapse are likely to be more violent than similar failures of single-walled vessels.

Causes of collapse failures of jacketed vessels include deterioration of the walls through wear, corrosion, etc., similar to single-walled vessels. But they also include malfunctioning of apparatus used in connection with the pressure supply and control of the heating medium. Failures of safety valves, pressure reducing valves, boiler controls and mishandling of valves and connections can cause excessive pressure in jackets and result in collapse of a vessel that is in good phyisical condition.

Reducing Valve Failure

Collapse of jacketed vessels resulting from overpressure in the jacket are numerous, and frequently stem from improper functioning of pressure regulating devices. A recent failure involving a 14 ft diameter brew kettle is a case in point. The steam line leading to the vessel was equipped with a reducing valve set to limit jacket pressure to 35 psig. The reducing valve failed, permitting excessive steam pressure in the jacket and causing the inner shell to bulge inward and rupture. There was a safety valve in the steam line on the low side of the reducing valve, but this apparently did not open immediately when the reducing valve failed, although it worked satisfactorily when tested after the accident.

Valve Operating Error

Overpressure due to an operator's error caused the collapse of a jacketed vessel used for processing. Normally, products were cooled in this vessel by circulating cooling water through the jacket, the water being admitted to the bottom of the jacket and allowed to overflow through an outlet line at the top. However, on occasion steam was used in the jacket for heating purposes and at such times it was necessary to close the overflow line, so a stop valve was provided. The vessel was being used for cooling purposes when the accident happened. The operator, desiring to shut off the cooling water supply, thoughtlessly closed the overflow valve instead of the water inlet valve. Water pressure at 68 psig built up in the jacket and collapsed the inner shell, which was built for a safe working pressure of only 10 psig.

Incorrect Piping

An incorrect piping connection led to overpressure and violent collapse of another processing kettle. This vessel was connected to a 15 psig steam line. Shortly after it had been installed, and while the steam line was still closed, the operator opened a valve in the condensate drain line. The inner shell, or head, suddenly collapsed and tore halfway around a riveted seam. It was then discovered that the drain line had been connected into a condensate header used in common by other vessels operating at 125 psig. High pressure steam from this header entered the jacket when the drain valve was opened.

Overpressure from an unusual cause resulted in the collapse of a jacketed kettle used in another plant. A patented heat transfer medium, instead of steam, was used in the jacket of this vessel. Because safety valves on the boiler that heated the medium were set to relieve at a pressure equal to the safe working pressure of the kettle, it was believed that overpressure could not develop in the jacket and no safety valve was installed on the vessel itself.

Inlet and outlet lines to the jacket were provided with stop valves, however. The accident happened after these valves had been inadvertently closed, trapping a quantity of liquid in the jacket. The contents space of the vessel was then filled with products at a temperature of about 600 F. This caused the liquid in the jacket to boil and build up pressure, which collapsed the inner shell.

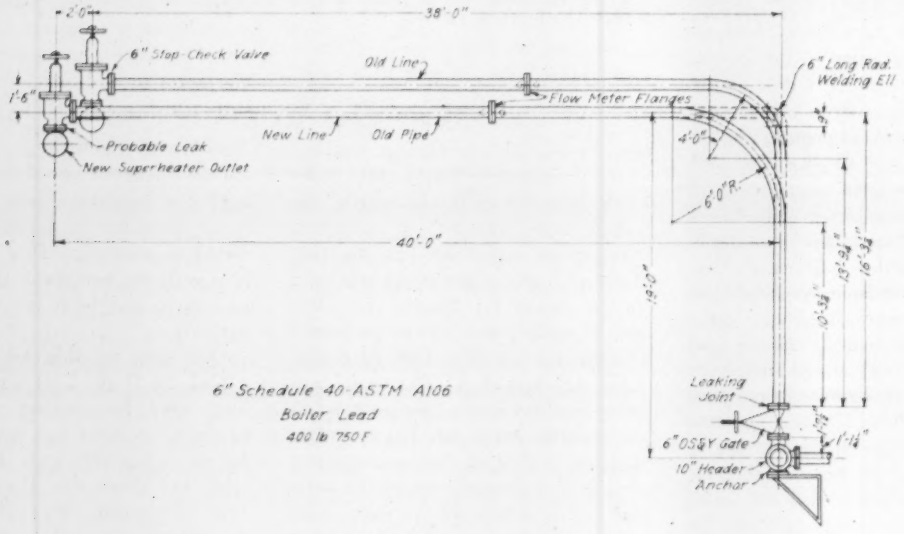
Accidental Vacuum

Occasionally a vessel intended and used for operation only under internal pressure is accidentally subjected to vacuum. This may result in a collapse, especially if the vessel is a large one built for a moderate pressure.

One case of this kind involved a tank 10 ft in diameter and 42 ft long used for storing a chemical product. A vent line was provided for use when filling or draining the tank, but there was a valve in this line which was kept closed while the vessel was full to prevent admission of air which would affect the quality of the product. The vessel collapsed when operators forgot to open the vent while draining the vessel. Removal of the contents without admitting air caused a high vacuum to develop and one side of the tank caved in to form a dent 3 ft deep and 14 ft long in the shell.

Feedwater Receiver

In another instance a feedwater receiver 14 ft in diameter and 34 ft long was involved. This vessel operated normally at 6 psig internal pressure. Protection against over pressure was provided by a water seal, 4 in. diameter, which would blow at 8 psig. The accident happened after the tank was allowed to run dry, cutting off feedwater supply to the boilers. The operator, in his haste to get water to the feedpumps, forgot to use a bypass line around the receiver provided for such emergencies and fed cold, raw water directly into the tank. The vessel was full of steam, which condensed rapidly upon contact with the cold water, creating a vacuum and collapsing the shell in spite of the fact that air rushed into the vessel through the 4 in. water seal. One side of the tank was pushed in 8 ft — more than half the diameter. The deformation extended practically the full length of the 34 ft vessel.



"WE TAKE OUT THIS BEND," he said, "and put straight pipe with a long radius welding ell in place of it. Pull that cross line cold 1¼ in. and the vertical line about ⅝ in. And you are all set."

"It Looked So Simple"

. . . a piping problem and how it was solved

By Bill Dopp

• *Almost anything can happen when you're in the engineering, operating, contracting or sales ends of the heating, piping and air conditioning industry. The objective of this more-or-less regular editorial feature in HPAC is to discuss practical problems that need solving — and ways to solve them.*

Bill Dopp has had 40 years of experience dealing with piping and including a long stretch of service as a sales engineer. He is devoting some of his present leisure to drawing on his many piping experiences, as he does in this story . . . .

"HELLO, MAC. YOU'RE just the fellow I want to see." Herman Shultz welcomed Martin MacVane, the gasket salesman.

"What's the trouble, Herman?" Mac's interest was genuine. Herman was an old friend. Ever since he had taken over the job of chief engineer for the Southern Food Products Co. plants, Herman had been buying all of his packing from Mac. He, in turn, often gave his engineer friend advice and help in solving his packing problems.

"Frankly, Mac, I don't know," confessed Herman. "You know that we put in a new 400 lb boiler up at the York St. plant. Got the whole thing hooked up and now the trouble begins."

"Boiler priming?," asked Mac.

"We've Had To Shut Down"

"No, we got the boiler clean and steam up. Everything went fine until we put the boiler on the line. It's a regular hook-up with a gate valve on top of the header and a bend coming into it from the boiler. Just as soon as that line gets hot, the joint on the up side of the valve begins to leak. We've had to shut that boiler down a couple of times to tighten up the bolts. Tim just called and said that now they have broken one of the bolts. I just don't know what to do."

"Do you have a drawing of that layout?," Mac asked.

"Sure — look here." Herman unrolled a set of blueprints and spread them out on his desk. "Here's the boiler outlet. The superheater nozzle points upward. We are using the old angle stop-check valve. Cleaned it up, of course, and it's in good shape. Then here is the boiler lead. Had to make it in two pieces to get in the flow meter nozzle, but that joint's all right."

"And this is your lovely bend?," inquired Mac.

"Yes — but why the sarcasm?" Herman looked at Mac with a curious expression of concern.

"Sorry. I didn't mean to be rude, Herman." Mac was scanning the entire drawing thoughtfully. "Who designed this set-up?"

"We did — that is, Tim and I did. Why — what's wrong with it?" There was a suggestion of annoyance in Herman's voice.

"Did you calculate the stresses in that boiler lead?" Mac asked slowly.

"Well . . . . . Honestly, Mac, I tried to get some idea of what they would be but, do you know, I've forgotten most of the math I learned in college. Then I tried to find something in the handbooks that would help me and I got nowhere. So we just followed the old line. It was all right, and I couldn't see why this one wouldn't be the same."

"Why did you put in a new boiler?," inquired Mac. Herman had had previous experience with his gasket-selling friend and knew that he was on the pan.

"Why? Because we needed more steam, of course." He wondered where Mac was heading. "The old teakettle was giving us trouble anyway, and we didn't dare force it. Besides, we wanted to modernize as much as possible."

"This boiler going to give you what you need?"

"Sure — for the time being, at any rate," declared Herman. "We get twice as much steam out of this boiler as we did out of the old one, and it takes up less room. Then, too, this baby is o'l fired. That makes it really nice."

"It Got You Into Trouble"

"It also got you into trouble. I'll bet the old boiler lead was smaller than this one. What was the size and where was the outlet located?"

"Here, take a look at this old drawing. See, the old bend was 6 in., too. The outlet was almost in the same place — about a foot and a half higher up. I told you we used the old stop-check valve. The boiler man said that was the right size and would work okay. That's why we put the line just about as it was."

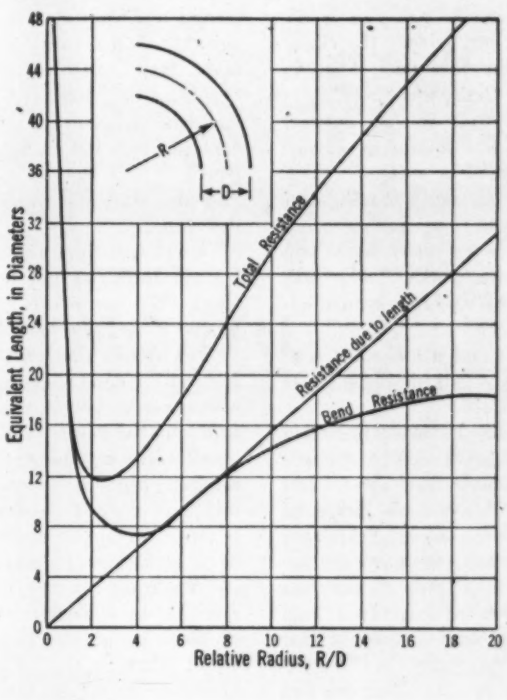
"Herman, it's the little things that start big wars. Look here at what you did. In the first place, you lowered the cross line 18 in. Then you increased the radius of the bend by 2 ft. Why did you do that?"

"The longer the radius, the lower the pressure drop," declared Herman.

"Oh, yeh!" answered Mac. "Have you got a resistance chart?"

"Yes, of course." Herman went to the bookcase and came back with a book, which he handed to Mac.

"Take a look at this chart. It shows the total resistance to flow in a bend, including the resistance due to length." Mac laid a ruler on the chart. "Now, a 4 ft radius is equal to eight diameters of your 6 in. pipe. Run a line up from eight diameters to the curve and we find the bend will equal 24 diameters in resistance.



RESISTANCE OF 90 deg pipe bends, in terms of equivalent length of straight pipe, for average flow conditions. (Based on work of K. H. Biej, given in his paper, Pressure Losses for Fluid Flow in 90 Deg Pipe Bends, Journal of Research of the National Bureau of Standards, Vol. 21, July 1938)

But a 6 ft radius is 2 ft longer so we must add that, or four diameters, to each end. That makes a 32 diameter total. Right so far, Herman?"

"Right," answered the attentive Herman.

"A 6 ft radius is 12 diameters. Here we find that this will produce 34 diameters of resistance or two more than your original 4 ft radius bend."

Mac grinned. The look on Herman's face showed bewilderment. "You see that you lost ground by lengthening that radius. Put a marker at that page. We'll want it later."

"Something Else Wrong?"

"Okay," said Herman slowly as he placed the marker. "What other tricks have you got up your sleeve? I suppose there is something else wrong?"

"Plenty," replied Mac. "You said the boiler outlet was in the same place as the old one. But it was 18 in. higher up. In other words, you shortened the short leg of your bend by that much. I'm sure you haven't forgotten so much that you won't recognize our old friend, the cantilever deflection formula. That is $(fl^2)/3\ E\ y$. Remember that?"

Mac didn't wait for an answer. "That length is l square in inches. See what your 18 in. means? Then to top it off you take 2 ft more and put it into your long radius bend. Herman, you were really bound on gumming up the works." Mac was laughing at his friend in a sympathetic way.

"Gosh . . . . and it looked so simple." Herman looked ruefully at the drawing.

"Never mind, Herman, there's a way out of this. I don't think it's as bad as it looks just now. You see, a lot of things have happened since you went to school. Years ago, the first table for computing the expansion value of pipe bends was published. We used it for a long time until engineers discovered that a quarter bend really had no expansion value at all. Then the fun began. There have been many investigators who have published data since then, but there still isn't complete agreement on how to figure stresses and anchor loads."

Mac leaned back and looked at Herman through half-closed eyes. "There's where the consulting engineer comes in. It's his business to keep up with all that is going on, not only in the piping field but in every part of the engineering world. He's supposed to evaluate the information and gets paid for properly applying the results to your problems. Now, let's take another look at this thing."

"Mac, how do you keep up on all of these things? After all, this is not your funeral — yet you step in and help out as if it were your own problem. I know now that you're going to get us out of this fix. I'm more than grateful for your help."

"You buy my packing and gaskets, don't you? So who's unselfish? Now, let's see. You've got 40 ft across here from the boiler outlet to the header. The pressure is 400 lb and the temperature is 750 deg. That's 6 in. expansion per 100 ft or 2.4 in. for your 40 ft. Half of that is 1¼ in. Now, according to the Code for Pressure Piping, you can cold-spring your pipe one-half the total expansion. They threw a hook into that, though, by only allowing you to take credit for 66 percent of the cold spring or not more than one-third of the total. One-third of 2.4 in. is 0.8 in. so we take half of that from 1¼ in. and we come up with 0.8 in. again." Mac's pencil moved rapidly as he talked. "By the way, did you cold spring that pipe?"

"I was just thinking of that, Mac. I don't think we did cut that pipe short. We intended to, but I have a hunch it was overlooked."

"No wonder that gasket keeps going out. I don't know what kind of a load you've got on that joint. Before long the lower joint on the stop-check valve will be doing the same thing." Mac put down the pencil and took a small slide-rule from his pocket. "You put down the figures as I give them to you."

"According to the code, carbon steel has an allowable bending stress of 8700 lb at 750 deg. You can check that later. Your drawing shows 16 ft, 3¼ in. from the top of the valve flange to the center of your cross line. Let's say it's 200 in. for the sake of easy figuring. Squaring that we get 40,000. Then we have 8700 times 40,000 for the top side of our equation. Divide that by 3 times 25,000,000 times 3.31, or half the OD of 6 in. pipe. That ought to get us an answer that will tell what we can do."

"Where do you get the 25,000,000?," asked Herman.

"That's the modulus of elasticity of steel at 750 deg."

"I'm darned if I can figure how you know all these figures." Herman's voice had a quality of awe in it.

"That's easy," replied Mac. "When you're working with certain figures all the time you just can't help remembering some of them. . . . . Well, there we have it." He made a few quick moves with the slide-rule, and leaned back smiling. "That's fine," he exclaimed, "we've got 1.4 in. to play with. We only need 0.8. So here's what you do." He pulled the drawing of the new line toward him and started using his pencil.

"Now You're All Set"

Herman leaned over. He watched Mac draw a straight pipe to the down center-line and another up to the cross center-line. Then he drew in a welding ell. "We take out this bend," he said, "and put straight pipe with a long radius welding ell in place of it. Pull that cross line cold 1¼ in. and the vertical line about ⅝ in. And you are all set."

"Just a minute, Mac. Why a long radius ell? You said that the shorter the radius, the less the pressure drop." Herman's broad grin indicated he thought he'd caught Mac napping.

"Take a look at that chart again," said Mac. "Do you see how that curve dips? The low point is just beyond two diameters. A long radius welding ell has a radius of one and a half diameters. Can't do much better than that, can you?"

"That's less than the 4 ft bend," said Herman, studying the chart.

"Don't let that deceive you," warned Mac. "Remember that you must take into account the straight pipe to replace the longer bend. Nine inches from 4 ft is 3 ft, 3 in. There are two legs to consider, so that's 6 ft, 6 in. or 13 diameters. Add 13 more from the table and you've got 26. That's two more than your 4 ft bend. But, it's still eight less than the 6 ft bend."

"Boy, what I don't know about designing piping would fill a book." Herman was contrite. "Mac, you've really saved my bacon. I am in a lot more trouble than I realized. This is going to cost us something — but not anywhere near what a shutdown would cost.

"Will It Affect Flow Meter?"

"Forget it, Herman, it's always a pleasure to help you." Mac put away his slide-rule. "Let me warn you about something else."

"Now what?" Herman's voice showed concern.

"You've got a flow meter in that line. Write to the people who furnished it and ask them to tell you whether the change in reactive turbulence will affect the calibration of the flow meter. Don't do anything until you get them to say 'yes' or 'no' to your question."

"I don't understand, Mac. What can this have to do with the flow meter?" Herman looked at the

drawing with a puzzled expression that made Mac smile.

"Some years ago I had a similar case. We applied exactly the same remedy. The flow meter was closer to the bend, however, than yours is. I asked the same question. I got positive assurance that there was no such thing as reactive turbulence. 'Go ahead,' they said, 'it's all right.' Then when they had to send a man out to recalibrate the flow meter they really put up a howl."

"I'll sure take that precaution, Mac. But what do you mean by reactive turbulence?"

"Herman, you know that when a fluid goes around a bend it creates a whirling or spiral turbulence. Well, there is some evidence that this action, once it gets going, crawls back up the pipe against the flow. Just how far back up the pipe this influence goes no one seems to know. It's like the ripple you see above a stone in a rapidly flowing creek. The faster the flow the greater the upstream wave. It seems to be the same thing in a pipe. Lots of people deny that it exists, but one flow meter salesman I know isn't going to give anyone a blanket okay to change a pipe line anywhere near his flow meter." Mac chuckled at the recollection.

"I'm certainly grateful for your help, Mac. Anything I can ever do for you will be a pleasure." Herman didn't quite know how to express his gratitude.

"Okay, Herman, just remember that running a plant is one thing and designing a pipe line may be quite another."

"That I have learned the hard way," said Herman. "And it looked so simple." They both laughed as Mac waved goodbye.

QUESTION OF THE MONTH

• *IF YOU DON'T HAVE the answer to a problem, chances are someone else does — or can be helpful on part of it. That's the reason for HPAC's Question of the Month "idea exchange."*

• *YOU ARE INVITED to contribute a question for publication, or an answer to a published question. Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

How We Removed Scale from Piping

IN ANSWER TO the problem about removing scale from building piping systems — about which a reader asked in the June issue of HPAC — I would like to inform him of a method we used in solving a similar situation in our building.

Recently, we have had numerous complaints about the temperature of the hot water being too low, even though the temperature at the heater was excessive.

By the process of elimination, we found the cause of the trouble to be severely restricted return lines before the circulating pump. A live steam line was connected to these lines and during the weekend, the steam was left to soften the rust and scale.

Before Monday, the lines were blown and flushed several times. Since then the hot water service has improved considerably.—LEO PIVETZ, Jr. Engineer.

READER ASKS —

Use Doorway Air Curtain To Keep Dust Out?

"I was interested in an article in HPAC about using doorway air curtains to keep flies out of buildings, such as restaurants," writes G. J. DeT.

"It has occurred to me," he says, "that a similar air curtain could be used to keep dust out. I would appreciate any comment or information from other readers along these lines."

Boiler Sales Ahead of Last Year

SALES OF STEEL boilers for the first four months of 1953 were 115 percent of sales during the corresponding period a year ago, R. A. Locke, president and manager of the Steel Boiler Institute, reported at the SBI's 25th annual meeting.

Mr. Locke was re-elected president and manager and Arthur P. Weiss, of the Burnham Corp., was re-elected vice president.

The importance of having everyone in the boiler heat industry take advantage of every opportunity to acquaint the public, architects and builders with the fact that summer cooling can be obtained in connection with hot water and steam heating systems was emphasized at the meeting.

It was decided to place greater emphasis on the periodical use of boiler water compounds. Many manufacturers of boilers are providing compound without charge for the treatment of boiler water when the boiler is installed. It was pointed out at the meeting that the annual use of boiler water compounds offers an attractive opportunity for sales and service to heating and piping contractors.

Insulated Stack Promotes Comfort

COMFORTABLE WORKING conditions in an industrial plant, generating station, or boiler room can often be achieved through an appropriate application of thermal insulation.

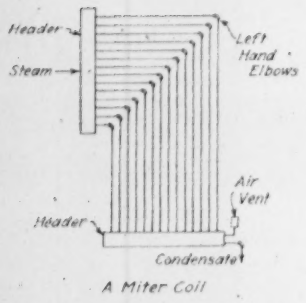
The insulation applied to the 12 ft diameter stack at the Hutsonville (Ill.) generating station of the Central Illinois Public Service Co. is an example of this type of "insulation engineering." Because the station is right next to a railroad siding, it was necessary to erect the stack entirely within the building proper — and it represents a surface of some 5000 sq ft generally at about 260 F.

To insulate the stack, 2½ in. thick blocks of 85 percent magnesia were wired into place and further secured with hexagonal wire mesh. Two ¼ in. coats of asbestos insulating and asbestos hard finish cement were then troweled on and the insulation finished with a pasted jacket of 8 oz canvas. Based on past experience, Sargent & Lundy, engineers, have found that this insulation will have a surface temperature of about 25 F above the ambient air temperature.

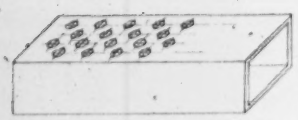
SAM LEWIS

Paper Mill Engineer Asks:

Should I Repair or Replace Old Steam Heating Coils?



A Miter Coil


Arrangement of Pipes in Header

SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems. He answers here a question from an engineer at a paper manufacturing plant about the replacement or repair of some 40 year old steam heating coils, describing in some detail the construction and characteristics of this type of surface

AN ENGINEER IN a big paper manufacturing plant described recently some 40 year old steam heating convectors, and asked me about replacing them.

An oldtimer would recognize the construction as being one of the very best ones of its day — and, to my mind, still good. The old 1 in. plain butt welded pipes, however, have commenced to leak; having replaced more modern types of equipment on several occasions in periods of time much shorter than 40 years, I must make a bow to this old construction.

The old paper mill has 24 rows of pipe, in six four-row sections. Each section is made up with two headers, each a cast iron box about 7 ft long. Each header has a cross section probably 6 in. by 4 in.

The casting was made by pouring the molten iron between the outer sand and a pre-baked sand core. The heat of the hardening metal disintegrated the core to sand that could run out through a relatively small opening. One side of each casting then was drilled and tapped with a right hand thread to receive the 1 in. interior diameter pipes.

One header usually was vertical, say at the upper left hand corner of a rectangle, and the other was horizontal at the lower right hand corner of the rectangle. The 1 in. threaded openings may have been about 2⅛ in. on centers and were staggered or alternated in the direction transverse to the casting. In building up each section, a length of pipe, say the top horizontal one, was threaded right hand at one end and left hand at the other end. The pipe was screwed into the header and a left hand threaded cast iron elbow was screwed on the left threaded opposite end of the pipe.

The next operation was to prepare a similar right and left threaded 1 in. pipe and to screw the right end into the proper opening in the horizontal second header, counting the number of turns of the pipe before it became tight. Following this, the pipe was unscrewed and its left threaded end was screwed into the left hand elbow, the number of turns again being recorded and the pipe again being removed. If the pipe went eight turns into the header and six turns for example, into the elbow, then in final assembly, the difference — two turns — was made into the header before the left hand thread at the elbow was engaged.

After the pipe was tightened into the two openings, there would be nearly positive assurance that there would be no leakage. This process was repeated for every pipe. The convector was called a miter coil.

Steam entered the vertical header, from it was forced through all of the horizontal branches, then through the elbows, and then down to the horizontal header.

By the time the steam and the resulting condensate reached the horizontal header, there would be a considerable volume of hot water which usually was removed through a threaded opening at one end of the header.

The steam usually entered the vertical header through a threaded opening in the side of the header opposite the 1 in. pipes and midway of its length.

The distance between the headers of a miter coil traversed by the steam was much shorter from the bottom of the vertical header to the left pipe of the horizontal header, as suggested by the accompanying sketch.

The steam and condensate and interior air travel was one-way, and like the one-way streets of cities, the progress was efficient.

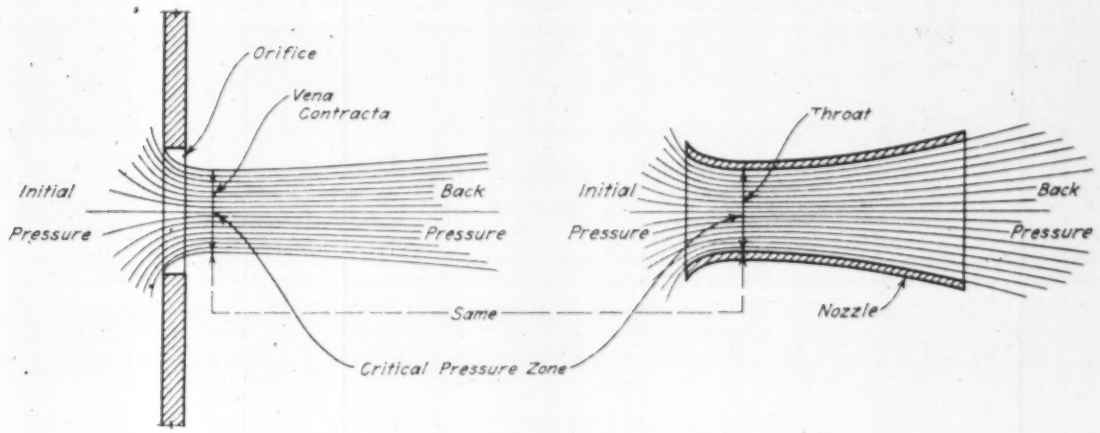
The interior air, cooler than the steam, easily was removable close to the top of the horizontal header. The air exterior to the pipes and circulated by the fan, meandered between and around the pipes; with steam at a temperature of 212 deg, it would deliver the air at a temperature about 130 deg above an entering temperature of zero.

The suggestion is made that since the aged pipes are leaking, they should be replaced.

The new types of tubes of course will weigh very much less than did the old miter coil of commensurate steam condensing capacity. Eight of the new tubes with their gills may do the job of the old 24 pipes.

The old pipes, being threaded, must expose some of the threads to the exterior air, leaving the metal wall reduced in thickness close to the headers and the elbows. Leaks first may develop at these junctions.

My answer to the paper mill's engineer is that, while careful consideration should be given to replacing this old heat transfer surface with a more modern type, he should also give serious consideration to rebuilding the old miter coils with new 1 in. pipes.



THE VENA CONTRACTA for orifice flow corresponds to the throat of a nozzle

Discharge of Air Through Orifices

TWO FORMULAS were used in calculating the volume of air discharged through various sized orifices as given in the table on the next page. Two formulas were necessary because of the phenomenon of critical pressure in gases flowing through nozzles and orifices.

Critical Pressure Defined

Since the vena contracta for orifice flow corresponds to the throat of a nozzle, as shown in the sketch, the following discussion pertains to both devices.

For each gas flowing through a nozzle, the throat pressure has a definite and constant relation to the initial pressure, providing the back pressure does not exceed the throat pressure. When the throat pressure meets these conditions it is called the *critical pressure*. But if the back pressure exceeds the critical pressure, the throat pressure then becomes equal to the back pressure. Flow is independent of the back pressure when the critical pressure is greater than the back pressure — but it is dependent on the back pressure when the latter exceeds the critical pressure. The proper flow formula is determined by the relation of critical and back pressures.

Selecting Flow Formula

In the case of air, the critical pressure has been found to be approximately equal to 0.53 times the initial pressure. If air at 5 psi gage [19.7 psi absolute] is discharging to atmosphere through a 1 in orifice, the critical pressure should be 0.53 × 19.7 psi absolute or 10.4 psi absolute. Since this is less than the back pressure, the flow formula

$$W = 1.06A\sqrt{\frac{P_1(P-P_1)}{T}}$$

should be used. In this formula, W = discharge, lb per sec; A = orifice area, sq in.; P = initial pressure, psi absolute; P_1 = discharge or back pressure, psi absolute; and T = initial absolute temperature, F (460 plus thermometer reading).

In cases where the initial air pressure is 13.1 psi gage or greater and discharge is to atmosphere, the critical pressure will exceed the back pressure and the formula proposed by S. A. Moss

$$W = 0.5303\frac{ACP}{\sqrt{T}}$$

should be used. The symbols are the same as those given above, with C being the coefficient of flow = 1.

Since the discharge is given in pounds, the volume can be found by dividing the weight of discharge by the weight of air per cu ft at the discharge pressure and temperature. The weight of air at 70 F temperature and 14.7 psi absolute pressure is 0.075 lb per cu ft.

DISCHARGE OF AIR through orifices

Cubic Feet of Free Air Per Minute at Standard Atmospheric Pressure of 14.7 lb per sq in. abs. and 70 F

Area, sq in.	1/64" .00019	1/32" .00077	3/64" .00175	1/16" .00307	5/64" .00479	3/32" .00690	7/64" .0094	1/8" .01227	9/64" .01553	5/32" .01917	3/16" .02761	7/32" .03758	1/4" .04909	9/32" .06213	5/16" .07670	3/8" .11045	7/16" .15033	1/2" .19635	9/16" .24850	5/8" .30680	3/4" .44179	7/8" .60132	1" .78540
Pressure, Lb per Sq in., Ga																							
1	0.028	0.112	0.253	0.450	0.700	1.06	1.48	1.80	2.27	2.80	4.0	5.5	7.2	9.1	11.2	16.2	22.0	28.7	36.3	44.8	64.7	88	115
2	0.040	0.158	0.356	0.635	0.989	1.42	1.94	2.55	3.20	3.95	5.7	7.7	10.1	12.8	15.8	22.8	31.0	40.5	51.0	63.4	91.2	124	162
3	0.048	0.194	0.436	0.775	1.25	1.74	2.37	3.10	3.92	4.82	6.9	9.5	12.4	15.7	19.2	27.8	37.8	49.5	62.5	77.0	111	152	198
4	0.056	0.223	0.502	0.892	1.39	2.00	2.73	3.56	4.50	5.55	8.0	10.9	14.3	18.1	22.2	32.1	43.5	57.0	72.0	88.9	128	175	228
5	0.062	0.248	0.560	0.993	1.55	2.23	3.04	3.97	5.02	6.19	8.9	12.2	15.9	20.1	24.7	35.7	48.5	63.5	80.1	99.3	143	195	254
6	0.068	0.272	0.612	1.09	1.70	2.45	3.32	4.34	5.49	6.75	9.8	13.3	17.4	22.0	27.1	39.1	53.0	69.5	87.9	108	156	213	278
7	0.073	0.293	0.695	1.17	1.82	2.63	3.58	4.68	5.90	7.29	10.5	14.3	18.7	23.6	29.2	42.2	57.3	75.0	94.7	116	168	230	300
9	0.083	0.331	0.741	1.32	2.06	2.96	4.05	5.30	6.70	8.24	11.9	16.2	21.2	26.9	33.0	47.7	64.7	84.7	106	132	191	260	339
12	0.095	0.379	0.856	1.52	2.37	3.41	4.65	6.07	7.66	9.42	13.6	18.6	24.3	30.7	37.8	54.6	74.1	97.0	122	151	218	297	388
15	0.105	0.420	0.945	1.68	2.62	3.78	5.15	6.72	8.50	10.48	15.1	20.5	26.9	34.0	41.9	60.5	82.5	108	136	168	242	329	430
20	0.123	0.491	1.100	1.96	3.05	4.40	6.00	7.86	9.92	12.12	17.6	24.0	31.4	39.8	48.8	70.7	96.0	126	159	196	285	385	503
25	0.140	0.562	1.26	2.25	3.50	5.05	6.88	8.98	11.38	13.99	20.2	27.4	35.9	44.5	56.0	80.9	110	144	182	224	325	440	575
30	0.158	0.633	1.42	2.53	3.94	5.68	7.7	10.1	12.77	15.70	22.7	31.0	40.5	51.3	63.0	91.1	124	162	205	253	365	496	648
35	0.176	0.703	1.58	2.81	4.38	6.31	8.6	11.3	14.26	17.60	25.3	34.5	45.0	57.0	70.0	101	137	180	227	281	405	551	720
40	0.194	0.774	1.74	3.10	4.84	6.97	9.5	12.4	15.65	19.31	27.9	38.0	49.6	65.0	77	112	151	198	250	310	446	607	795
45	0.211	0.845	1.90	3.38	5.27	7.60	10.3	13.5	17.05	21.00	30.4	41.4	54.1	68	84	122	165	216	273	338	487	662	865
50	0.229	0.916	2.06	3.66	5.71	8.22	11.2	14.7	18.60	22.90	32.9	44.9	58.6	74	91	132	180	235	296	365	528	718	938
60	0.264	1.06	2.38	4.23	6.60	9.50	12.9	16.9	21.40	26.35	37.9	50.8	67.6	85	105	152	207	271	342	422	609	828	1082
70	0.300	1.20	2.69	4.79	7.45	10.55	14.7	19.2	24.25	29.90	43.0	58.6	76.7	97	120	175	235	307	388	479	690	939	1227
80	0.335	1.34	3.01	5.36	8.33	12.04	16.4	21.4	27.10	33.35	48.1	65.5	85.7	108	131	195	262	343	433	537	771	1050	1371
90	0.370	1.48	3.33	5.92	9.25	13.34	18.2	23.7	30.00	36.90	55	72.5	94.8	120	147	213	289	379	478	592	853	1161	1516
100	0.406	1.62	3.65	6.49	10.50	14.58	19.9	26.0	32.80	40.50	58	79	104	132	162	234	316	415	523	649	934	1272	1661
110	0.441	1.76	3.96	7.05	11.00	15.82	21.5	28.2	35.60	43.90	63	86	113	143	176	254	345	452	570	702	1016	1385	1806
120	0.476	1.91	4.29	7.62	11.40	17.15	23.4	30.5	38.51	47.50	68	95	122	154	190	274	373	488	616	712	1097	1494	1951
125	0.494	1.98	4.45	7.90	12.30	17.79	24.2	31.6	40.00	49.25	70	99	126	160	196	284	386	506	638	789	1138	1549	2023
150	0.582	2.37	5.31	9.45	14.75	21.20	28.7	37.5	47.45	58.25	84	115	150	190	234	338	459	600	758	910	1315	1789	2338
200	0.761	3.10	6.94	12.35	19.15	27.50	37.5	49.0	62.00	76.2	110	150	196	248	305	441	600	784	990	1225	1764	2401	3136
250	0.935	3.80	8.51	15.18	23.55	34.00	46.2	60.5	76.15	94.0	136	184	241	305	376	542	738	964	1218	1508	2169	2952	3856
300	0.995	4.88	10.95	18.08	28.25	40.55	55.0	71.8	90.6	111.7	161	220	287	364	446	646	880	1148	1454	1795	2583	3515	4592
400	1.220	5.98	13.40	23.81	37.10	53.45	72.4	94.5	119.4	147.0	213	289	378	479	590	851	1155	1512	1915	2360	3402	4630	6048
500	1.519	7.41	16.62	29.55	46.00	66.5	90.0	117.3	148.0	182.5	264	358	469	593	730	1055	1430	1876	2360	2930	4221	5745	7504
750	2.240	10.98	24.60	43.85	66.15	98.5	133.0	174.0	220.0	271	392	531	696	881	1084	1566	2125	2784	3510	4350	6264	8525	11136
1000	2.985	14.60	32.80	58.21	91.00	130.5	177.0	231.0	291.5	360	520	708	924	1171	1440	2079	2820	3696	4650	5790	8316	11318	14784

Table is based on 100 percent coefficient of flow. For well-rounded orifice, multiply by 0.97. For a sharp-edged orifice, a multiplier of 0.65 will give approximate results. Table presented through courtesy of Armstrong Machine Works. Values from 150 to 1000 psi calculated by Ingersoll-Rand Co.

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL *SECTION*

Automatic Permeance Measurement by the Permeometer

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This paper is the result of research sponsored by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS in cooperation with The Pennsylvania State College, State College, Pa.

SUMMARY—The *Permeometer* obtains a measurement of the water vapor permeance of building papers or vapor barriers in a single observation, and eliminates weighing of cups, used in other methods, or the maintaining of a humidity controlled room. Other features, including a simple standardization, insure dependable results without special care or skill of the operator. The *Permeometer*, therefore, reduces the time required for permeance determination when compared with gravimetric methods.

THE CONTROL of water vapor migration is vital to the packaging engineer and to the architect whose designs also become packages. Moisture exclusion is the objective in the packaging of metal parts while moisture retention is important in products such as foods and tobacco. A vapor barrier, or properly a vapor resistor, restricts moisture transfer to a permissible rate which depends on the application. An excellent barrier is necessary for long term storage while a higher transfer rate is allowable in house construction where the barrier function is seasonal. Very high moisture transfer, on the other hand, is sometimes an objective. For any application, the choice of a vapor control membrane involves its *permeance*, a characteristic of the sheet or film that requires definite measurement.

The *permeance* of a sheet is the reciprocal of its *resistance* to vapor passage. It is the ratio of the moisture transmitted through a unit area, in unit time, to the vapor pressure difference, the conditions being known. The term *permeability*, often loosely used in this sense, correctly relates to a property of the substance and is the permeance of a unit thickness of the material. The unit of permeance generally used by the building industry is the *perm* which is one grain per (sq ft) (hr) (in. Hg difference of vapor pressure). These relations are expressed in the following formula:

$$\text{Permeance} = W/(AT\triangle p) \quad \ldots\ldots\ldots (1)$$

where

W = the weight of vapor, grains.
A = area, square feet.
T = time, hours.
$\triangle p$ = vapor pressure difference, inches of mercury.

The measurement of permeance of a sheet material is generally accomplished by sealing a specimen to the top of a dish or cup which contains water or a desiccant, exposing it in a room or cabinet where the air conditions are carefully controlled, and weighing the assembly periodically to determine its rate of weight change. After a steady state has been established, the permeance can be calculated. This simple procedure has a number of variations but all involve weighing and therefore a considerable time may be necessary to obtain a weight change large enough to minimize the effects of scale insensitivity and of operational error.

To find a faster method was the original purpose of the project, started in 1950, in which the *Permeometer* was developed. Other objectives were soon added. These included:

1. A transfer of skill and accuracy from the operator to the machine.

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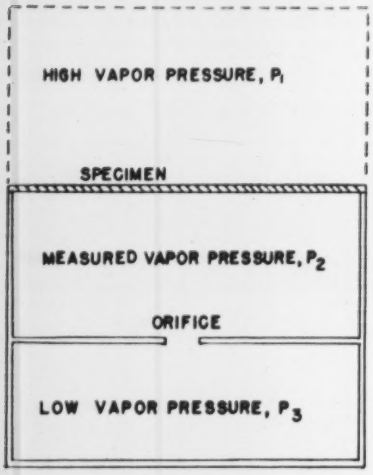

Fig. 1—Orifice measurement of vapor diffusion

2. A single observation of the measurement by the operator.
3. Elimination of humidity control from the operating space.
4. Elimination of precise temperature control and acceptance of the ambient temperature within the usual comfort range.
5. Easy standardization of the instrument.

Methods Investigated

To accomplish these objectives, consideration was given to several possibilities, all of which eliminate the need for weighing. The methods considered were based on the following natural phenomena:

1. The change in the dielectric property of a desiccant with changing water content.
2. The reflection of light from a cold mirror on which water vapor is allowed to condense.
3. The vapor pressure drop across an orifice in the vapor path.

Since the convenience of an electric measurement was attractive, a device based on the first principle was constructed. It indicated the changing capacitance at radio frequency of a condenser whose dielectric was a thin bed of silica gel used as the water vapor sink. Observations, however, indicated that the quantity measured, in relation to the moisture added, was a function too insensitive for quick results. It was also doubtful whether a single observation of the instrument would be adequate in a test. Other problems encountered added to the difficulties of the method and its development was, therefore, suspended.

Utilizing the second principle, another device was built which promised some convenience in obtaining a low pressure by the use of ice. After a steady state was reached a small silver mirror could be moved into the cold zone where it would condense the vapor flow in a small area. Photometer measurement of reflected light was a feature of the design which appeared attractive. However, the exacting control of heat transmission and temperatures that was needed presented obstacles and suggested that another approach should be investigated.

Orifice Measurement

The use of an orifice is the basic feature of the *Permeometer*. Orifice measurement of liquid or gas flow is accepted as a quick and dependable method but its use in measuring vapor diffusion has been somewhat neglected. Its utility was recognized by *The Institute of Paper Chemistry* as early as 1944 when a device providing either a fixed or manually adjustable vapor resistance was described.[1] The study of vapor flow through holes, made by Yeaple[2] in 1948, indicated that the vapor transfer may result from air convection as well as vapor diffusion. Such behavior is expected where a difference of air density provides an unstable condition, and its avoidance is vital to the procedure considered. As dry air is more dense than humid air the measuring orifice should be located in a horizontal plane with dry air below and humid air above it. The reversed conditions in the earlier device of *The Institute of Paper Chemistry* may have caused some irregularity in results although a "fairly accurate correlation" with gravimetric measurements of vapor transfer was reported. Unfortunately the gravimetric determinations were made under different exposure conditions, a fact that obscures the true accuracy of the method.

The essential requirements for orifice measurement with vapor flow downward are shown in Fig. 1. The orifice could be placed above the specimen instead of below, though the down-stream location is preferred for operational convenience in the apparatus developed, and for greater versatility. The high vapor pressure, P_1, may be the ambient pressure, if it is controlled; but generation of vapor within an enclosure as indicated is readily accomplished. The low pressure, P_3, should be essentially

[1]Exponent numbers refer to References.

Fig. 2—The *Permeometer*

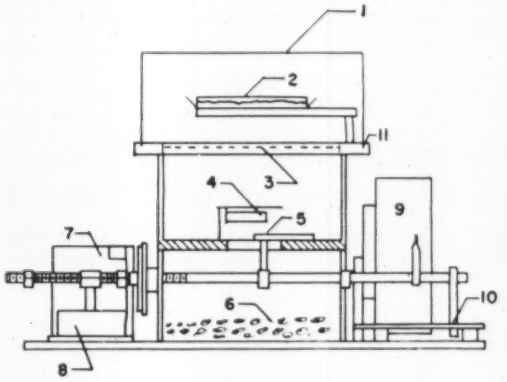

Fig. 3—The *Permeometer* assembly (elevation)

1. Glass cover
2. Salt solution, vapor source
3. Specimen in removable ring
4. Electric hygrometer, control element
5. Adjustable orifice and slide valve
6. Desiccant, vapor sink
7. Two phase balancing motor
8. Arresting potentiometer
9. Strip chart recorder
10. Valve position scale and pointer
11. Annular oil seal
12. Amplifier (not shown)

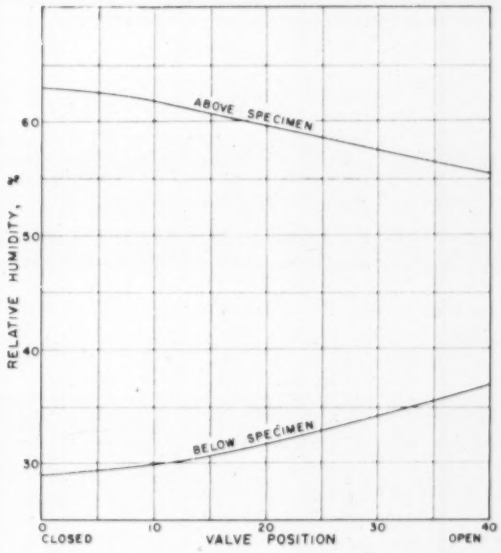

Fig. 4—Test conditions at 80 F (sodium nitrite vapor source)

constant and is maintained conveniently by a desiccant.

In Fig. 1, the fixed orifice restricts vapor diffusion and the vapor pressure above it reaches P_2 when a steady state is established. If P_2 is measured and the orifice calibrated, the determination of vapor flow is simple and the permeance becomes:

$$\text{Permeance} = f(P_2-P_3)/A(P_1-P_2) \quad \ldots\ldots\ldots\ldots (2)$$

where

f = calibration factor for orifice.

While the simple device is adequate in theory, it has certain objections. Accurate measurement of P_2, which will vary over a wide range for different specimens, becomes especially important at either limit. Such accuracy presents considerable problems and the widely different exposure for different specimens is also undesirable. Such problems are readily avoided by choosing a suitable orifice for each specimen or, more conveniently, providing an adjustable orifice.

Automatic Adjustment

Automatic adjustment of the orifice is a feature of the *Permeometer*. Essentially it holds a chosen vapor pressure, P_2, in the intermediate chamber. As there must be a different orifice size for each vapor flow rate and as each vapor flow rate results from a specific permeance of the specimen, it follows that each permeance requires a specific orifice opening. In short, the orifice opening is a direct function of the specimen permeance. When a steady state exists, it is necessary only to observe the orifice opening, converting its position to perms by reference to a calibration. Indeed, if desired, it is possible to graduate the indicating scale of the instrument in perms.

The device finally constructed after some preliminary designs, is shown in the photograph, Fig. 2, and its assembly is indicated in Fig. 3. This design provides the essential elements shown in Fig. 1 with the addition of automatic orifice adjustment and other features necessary to more complete self containment and ease of manipulation.

At the top, the vapor source is enclosed in a removable glass canopy. It is a saturated solution of sodium nitrite, chosen to provide a relative humidity in the 60 percent range. This is higher than the accepted level for *dry cup* tests but the difference is in a range where no major shift of permeance is ordinarily observed and, consequently, the exposure may be considered comparable to the standard. The glass dish holding the solution is placed on a swinging arm which may be moved to one side when the specimen is changed.

The specimen is mounted within a 6 in. diameter ring using the customary waxing technique for sealing the edge. The ring may be duplicated to allow a quick change of specimens and, in position, is sealed to the body of the apparatus. An oil seal has been used for this ring and also for the glass canopy as shown in Fig. 3. This type is very efficient and permits a quick change. However, the dripping of oil at the time of removal is an objection correctible by a wiping device not shown in the illustration. A synthetic rubber seal may also be adequate, a possibility to be investigated.

In the base of the apparatus, the low vapor-pressure chamber has a door at the front to admit a tray containing desiccant (silica gel). Vapor enters the top surface of the desiccant bed.

The measuring or control chamber is separated from the bottom compartment by a brass plate which has a 2 in. diameter orifice. Orifice adjustment is accomplished by a slide valve (Fig. 3, part 5) whose active contour is designed to provide large valve movement per unit area near the closed position but has a steadily

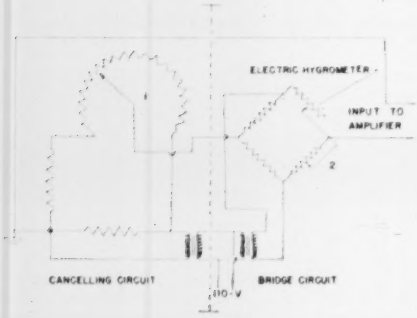

Fig. 5—Primary actuating circuit

increasing rate of area change as the valve is opened. This insures good sensitivity at any orifice opening. The valve is actuated by a shaft which moves axially below the orifice and passes through opposite sides of the desiccant chamber. This through-movement eliminates any pumping of air. Packing of the shaft at its bearings is not important since any stray vapor entrance is immediately adsorbed in the desiccant without entry into the measuring path.

Automatic adjustment of the valve is effected by a two-phase balancing motor which is connected through suitable gears to the threaded shaft and is controlled by the vapor pressure in the measuring chamber. The sensing element is a commercial electric hygrometer duplicating in principle the sensing method used by *The Institute of Paper Chemistry*.[1] This device is very responsive to relative humidity and is able to control the vapor pressure at a chosen value if the temperature is constant. (While constancy of temperature is presumed, variations are later considered.) The vapor pressure to be maintained in the measuring chamber has been arbitrarily chosen, about midway between the high and low vapor pressures. The corresponding relative humidity, 30 percent in the basic conditions, is shown in Fig. 4 at valve position 11. (Position is indicated on a uniform scale graduated with 28 units per inch.)

Fig. 4 shows that the top and bottom exposures of the specimen are not the same for all specimens. The vapor pressure above the specimen naturally diminishes as the rate of evaporation from the salt solution is increased. The vapor pressure below the specimen, increasing with the vapor flow, is so arranged as a matter of control stability which is later considered. These pressure changes however are not an obstacle to correct measurement. For any given permeance, or valve position which is a function of permeance, both exposures are fixed and the vapor pressures are definite. The altered pressures that are provided for another specimen of different permeance are fully taken into account in the calibration. The exposures, of course, are different from those provided in standard dry-cup tests and the *Permeometer* measurement is not expected to match the dry-cup permeance. It is, however, expected to be similar since permeance is a ratio which relates the vapor flow to the existing vapor pressure difference (Equation 1) and since experimental evidence indicates no wide change in permeance within the range of relative humidity under consideration.[3,4]

The electric control circuits that were developed for this instrument are shown in Fig. 5. Basically, a Wheatstone bridge is used in which one arm is the sensitive resistance of the electric hygrometer. The bridge output is amplified and supplied to the two-phase balancing motor which moves the valve to effect control.

Control of vapor diffusion, however, is a different matter from the control of a mass flow of water or steam by a valve. Diffusion response is necessarily slow, in fact it is so delayed that the valve may be moved a great deal with no immediately sensible change in the relative humidity above it. As a consequence, the basic circuit cannot function satisfactorily. An *open* signal

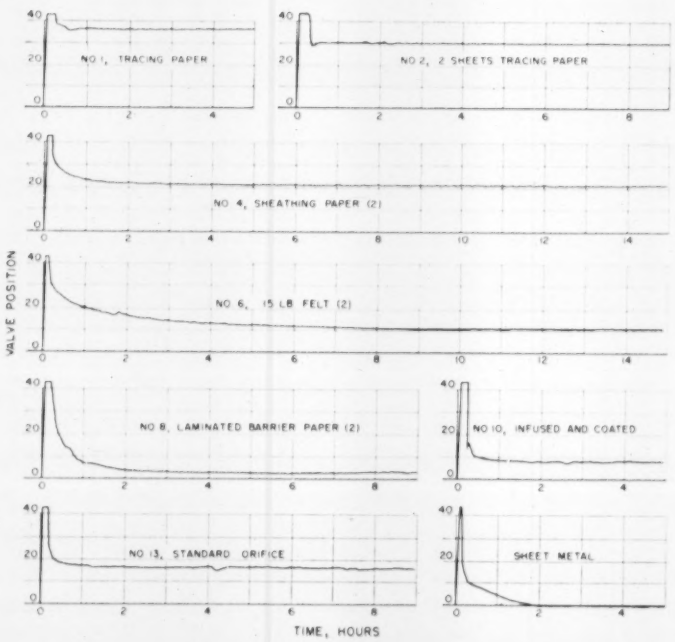
NO 1, TRACING PAPER
NO 2, 2 SHEETS TRACING PAPER
NO 4, SHEATHING PAPER (2)
NO 6, 15 LB FELT (2)
NO 8, LAMINATED BARRIER PAPER (2)
NO 10, INFUSED AND COATED
NO 13, STANDARD ORIFICE
SHEET METAL
VALVE POSITION
TIME, HOURS

Fig. 6—Recorder strip charts (specimen numbers in Table 1)

from the electric hygrometer would cause the valve to open wide. This, of course, would soon be followed by a *close* signal which would continue until complete closure would result. These oscillations would continue indefinitely and are caused not so much by insensitivity of the hygrometer element, as by the resistance of the air path to vapor diffusion and, to a minor extent, by the adsorption of vapor in the control chamber. The apparent effect is inertia of the vapor pressure.

A simple means of overcoming this difficulty is the *cancelling circuit* shown in Fig. 5. The essential element is the potentiometer (part 1) actuated by the valve movement as indicated in Fig. 3. A signal from the electric hygrometer that the relative humidity is too high opens the valve but the valve also moves the potentiometer, immediately restoring the balance and stopping the movement. This action effectively prevents hunting. It results, of course, in a controlled relative humidity that is higher at the open limit of the valve movement as shown in the upward sloping line in Fig. 4. The degree of slope is chosen for good regulation.

Strip Chart Record

When a specimen is placed in the *Permeometer*, the vapor pressure in the control chamber, resulting from the entrance of ambient air, is likely to be above its control range and the resulting signal causes the valve to open wide. Promptly the excessive relative humidity drops to 37 percent and the valve starts to close. Its movement, however, is not likely to be fast as the relative humidity continues to drop and the moisture which may be stored in the lower face of the specimen (if it is hygroscopic) is withdrawn. In time, a steady state is reached where the vapor supply to the control chamber is equal to the loss therefrom through the orifice. Thereafter, the valve position remains essentially unchanged, except for slight oscillations associated with electrical and other disturbances.

It is important that a record of the valve movement during the test be available to the observer so that he may know whether a constant position has been reached or the slow change is still continuing. This record is supplied by a strip chart carried on a rotating drum that is powered by an electric clock mechanism providing one revolution per day. The pen is carried by the shaft extension as also is the valve position pointer. The strip chart may be ruled in units of valve position (or of perms in a special case). Eight specimen charts are shown in Fig. 6. In each case, the test was continued several hours to show fully the behavior of the instrument, although the permeance was clearly indicated for some specimens in a much shorter time.

While the permeance of some papers may be measured in an hour, others require much longer. The weight of the stock, its hygroscopicity and previous exposure are factors that determine the amount of moisture stored in the specimen at the start. The test exposures usually involve an addition of moisture in the top fibers and extraction from the bottom fibers and the time required for these changes depends on the permeability of the material as well as the amount of moisture to be moved. These differences are evident in Table 1 which shows the time required for tests on various papers, mostly used in building, with the addition of other specimens suitable for the calibration of the instrument. The heaviest material shown, 15 lb felt, required 8 hrs for specimen 1, which had been in the laboratory for some time, whereas specimen 2, taken directly from an unheated storage (in October) required 13 hr. All other specimens had incidental laboratory exposure before they were tested. From these results, it appears that the permeance of building papers up to 15 lb weight can usually be measured in 8 hr, with 2 hr adequate for lighter papers.

No direct comparison of the *Permeometer* speed of measurement with that of a weighing method was attempted. In the latter case, the time is likely to be rather long since it is more a matter of efficient or convenient laboratory routine. It can be reduced, of course, by frequent and very exact weighing. In either method, a steady-state must be first established with as much vapor leaving one side of the specimen as

Table 1—Tested Permeance of Papers (at 80 F)

Specimen No.	Description	Weight of 100 sq ft Pounds	Permeometer Time**	Permeometer Position	Permeometer Permeance Perms	Dry Cup Permeance Perms
1	Tracing Paper (100% rag)	1.4	½	36.6	11.0 *	——
2	same, 2 sheets		¼	29.5	7.1 *	——
3	Sheathing paper, asphalt infused kraft (1)	2.7	8	26.2	5.6 *	5.4
4	same, another specimen (2)		7	21.2	3.6 *	3.5
5	15 lb Felt, roll roofing (1)	14.1	8	10.2	0.81*	0.75
6	same, another specimen (2)		13	10.8	0.95	——
7	Laminated and reinforced barrier paper (1)	7.2	8	4.5	0.27*	——
8	same, another specimen (2)		7	2.7	0.17	0.19
9	Asphalt saturated and coated barrier paper	10.5	5	6.8	0.45	0.46
	Insulation back-up papers:					
10	(*a*) Asphalt infused and coated one side	6.1	2	8.3	0.59	0.58
11	(*b*) Waxed one side, asphalt side ribbed	3.3	2	9.3	0.72	0.66
12	Celluose acetate	6.6	2	23.5	4.4 *	4.6
13	Standard orifice, 9/16 in. D. (equivalent perms)		1	16.3	2.2 *	——

*Permeance obtained simultaneously by weight and used for *Permeometer* calibration curve, Fig. 7.
**Time (hours) required for the *Permeometer* measurement.

is entering the other side. The periods required for this preliminary may be similar, although each can be shorter in certain cases. In the *Permeometer*, however, the measurement is complete as soon as a steady state is attained, whereas the weighing procedure begins to be useful at this time. Thereafter, the weighing must be continued long enough to record a change suitably large in relation to the weighing tolerance. When it is considered that a one-perm barrier paper in a 30 sq cm dry cup test[5] at 73.4 F allows only 21 milligrams weight gain in a day, it is evident that a 10 percent tolerance of results requires careful handling and at least one day of the steady state condition. Better barriers require a proportionately longer time.

The preliminary time necessary to establish the steady state has not been critically examined for either method. It is significant, however, in the method described that the average of the top and bottom exposures of the specimen is about 46 percent relative humidity which may be near to laboratory conditions. When this is true, the small rise (17 percent RH, or less) above the specimen when it is placed under test is about balanced by the relative humidity drop under the specimen, and the resulting changes in hygroscopic moisture are minimized, with a saving in time expected.

The calibration of the *Permeometer*, basically at 80 F, is presented in Fig. 7 showing the relation between valve position and permeance of the specimen simultaneously determined by the gravimetric method. The calibrating procedure required several specimens in a wide range of permeance with the vapor transfer accurately weighed after the steady state had been established and was being normally maintained. The weight determination was made by substituting a special canopy with a pipe stem of some length rising above it as a diffusion seal. Through this pipe, a wire was hung from an analytical balance to support the small glass dish containing the vapor source. Periodic weighings measured the rate of weight loss of the source which was the vapor transfer. Between weighings the dish was normally positioned by detaching the support wire from the balance and allowing a rubber plug on the wire to stopper the top end of the pipe stem. The vapor pressures above and below the specimen were determined by calibrated electric hygrometers and the permeance of each specimen was calculated by the formula, Equation 1. Eight specimens were used and the plot of each result is shown in Fig. 7 as a calibration curve at 80 F.

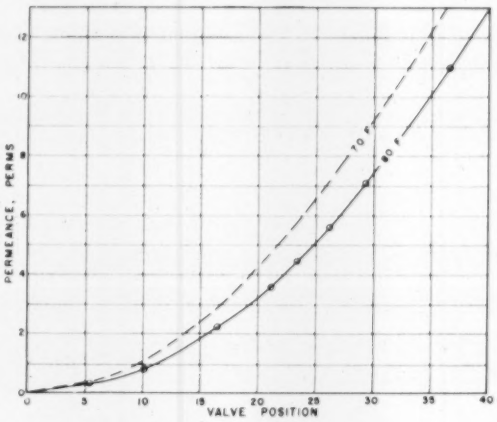

Fig. 7—*Permeometer* calibration

Standardization

One of the specimens was an orifice 9/16 in. in diameter in a 1/8-in. plate. This may be taken as a standardizing device, since its vapor transmission rate under given conditions is not subject to change. By this standard, the performance of the device can be easily checked and immediately restored to calibration if any change has occurred. Such a change in the electric hygrometer may occur in time and, indeed, another hygrometer element of different calibration may be substituted. In either case, standardizing is accomplished merely by adjusting the bridge circuit, Fig. 5. The potentiometer (part 2) is reset so that the valve automatically comes to rest at position 16.3 as recorded in Table 1, the temperature being 80 F. The validity of this simple procedure is provided in standard dependable elements: (1) vapor pressure of the source; (2) vapor pressure of the sink (with fresh desiccant); (3) exact duplication of the original vapor path. These conditions insure duplication of the original vapor pressure in the control chamber and the adjustment provides the correct response to that vapor pressure. Changes in other components of the primary actuating circuit are likely to be small and are corrected in the overall check described. Gross change, or failure of a component, is expected to be evident in the behavior. Changes in the amplifier also are similarly indicated.

In practice, erroneous results are avoided by: (1) periodic standardization; (2) maintenance of the water level at the source and (3) maintenance of fresh desiccant. Although the desiccant holding capacity is large, the dryness of the desiccant is assured only by a supply in good condition and frequent change. An additional feature, not shown in Fig. 3, is readily arranged, however, by placing a second appropriate electric hygrometer in the bottom chamber to provide a definite check of the desiccant condition.

Reproducibility of results is essential in any measuring device but failure to attain this goal has always been a bugaboo of water vapor transfer measurements. Experience with this instrument has indicated reproducibility within 10 percent for the same specimen. The difference in two specimens of the same paper is

another matter, which the instrument detects but cannot eliminate. Such differences are shown in Table 1.

Table 1 also presents the results of dry cup measurements on eight specimens previously tested in the *Permeometer*. The dry cup required a slightly smaller diameter and, therefore, the specimens are not strictly duplicates but are considered essentially so. However, a comparison of these results is not merely a comparison of an automatic device with a weighing technique since the permeance of the specimen is not a fixed property. Actually, it is also a comparison of the specimen's permeance under one set of conditions as shown in Fig. 4 with its permeance under another set of conditions (50 and 0 percent RH) which is considered standard for some purposes. The *Permeometer* results range from 10 percent below to 9 percent above the dry cup data, with the largest percentage applying to a permeance of 0.19 perm where a ratio is hardly justified. In fact, this permeance is below the satisfactory range of the instrument which is 0.3 perm to 12 perms as adjusted. (A lower range of permeance could be obtained with the same instrument by adjusting the vapor pressure below the specimen, Fig. 4, to a lower range.) However, this agreement of the two methods is close. It is doubtful if such agreement will be found for all materials, but if the exposures provided in the *Permeometer* are more like those encountered in service, its results are preferable for use.

The calibration curve, Fig. 7, shows the permeance of any membrane in the exposures actually provided and a clearly defined line is thus obtained. No scattering of test points is occasioned by the identity or characteristics, such as weight and hygroscopicity of the test specimen, but this effect would, of course, result ffom any failure of reproducibility by the device. An alternative calibration, or rather a correlation, could be considered, *i.e.*, plotting the *dry-cup permeance* against *valve position*, if this basis seemed desirable. This would occasion a considerable scattering of points due to the individualities of the test specimens and many more tests would be needed to obtain a representative correlation.

Operation of the *Permeometer* has been observed principally in a controlled temperature room at 80 F. Additional work at other temperatures is in progress, however, and a tentative calibration at 70 F is also shown in Fig. 7. Other curves at suitable intervals of temperature can be established. With this family of curves, it is evident that the *Permeometer* may be operated in any room having controlled temperature. It is also probable that an uncontrolled room, where temperature changes are moderate and slow, will suffice for ordinary requirements where precision is not required. Observing a thermometer within the glass canopy and the valve position, the operator enters his observations in Fig. 7, where interpolation provides the correct permeance.

Another application also requires further investigation. This is a permeance measurement that is comparable to the standard *wet cup*. It is expected that the *Permeometer* will make this measurement with equal facility when pure water (or a high vapor-pressure solution) is substituted for the sodium nitrite solution. Another family of calibration curves will apply.

Although experience with this instrument is limited, it has been demonstrated that automatic orifice measurement of vapor diffusion is practicable and that the *Permeometer* provides a quick, convenient determination which heretofore has been considered an exacting task requiring laboratory facilities and considerable skill on the part of the personnel. Its range of measurement is adequate for a wide variety of building papers. Thicker materials may also be tested though the time saving will not be important. Its accuracy and the reproducibility of results require further study, though these virtues appear to be adequately assured for the purposes considered. Its application may be found in quality control and development needs or in small laboratories where a more extensive installation is not justified.

Acknowledgment

The initial development of the *Permeometer* was made possible by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS in a research fellowship at The Pennsylvania State College and further advances were made under College sponsorship. The authors are indebted not only to the Society but to F. H. Yonker and P. L. Neyhart of the Engineering Staff and other associates, who contributed important advice and assistance.

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HOUSTON

in

January

1954

Honored by Life Membership

WALTER E. HEIBEL, district manager, Aerofin Corp., New York, N. Y., since joining the Society in 1917, has been an active member of the Society. A member of New York Chapter, he served as its president and vice president in 1937-38 and 1936-37, respectively. In addition to serving on several Technical

Walter E. Heibel
New York, N. Y.

Advisory Committees, including the TAC on Heat Transfer, Corrosion, and Air Conditioning in Industry, Mr. Heibel served on the Society's Nominating Committee, the Committee on Research, Publication Committee and a Special Committee to Study Publication Standards.

Born on February 18, 1888, in Warren, Pa., Mr. Heibel was graduated from Pennsylvania State College, with a B.S. in Mechanical Engineering in 1911. He began his career with American Blower Corp. as a sales engineer where he later became chief engineer. In 1924 he joined the Thomas Haverty Co., Los Angeles, as superintendent of construction, heating and ventilating work. Mr. Heibel left Haverty Co. in 1926 to go with Voorhees, Gmelin & Walker, in charge of the Heating and Ventilating Department. He began with Aerofin Corp. in 1929 as a district engineer. He has also done consulting engineering work.

Mr. Heibel is the author of a number of engineering articles and papers, and is a member of The Traffic Club, The 100 for One Club and Riverside Yacht Club.

L. G. PARROTT, member of the firm of Snyder and McLean, Detroit, Mich., was born on March 9, 1885 at Mt. Clemens, Mich. He attended the University of Michigan, graduating in 1911 with a B.S. in civil engineering.

Following graduation, Mr. Parrott joined the staff of Bryant & Detwiler Co. of Detroit as construction superintendent. From 1913-21 he was associated with the consulting engineering firm of Ammerman & McColl for whom he supervised mechanical and electrical installations. Mr. Parrott became a member of the firm, McColl, Snyder & McLean, successors to Ammerman & McColl, in 1921. The firm became Snyder & McLean in 1936 and Mr. Parrott has been a member of the firm to date, in charge of supervision of installation of mechanical and electrical installations.

L. G. Parrott
Detroit, Mich.

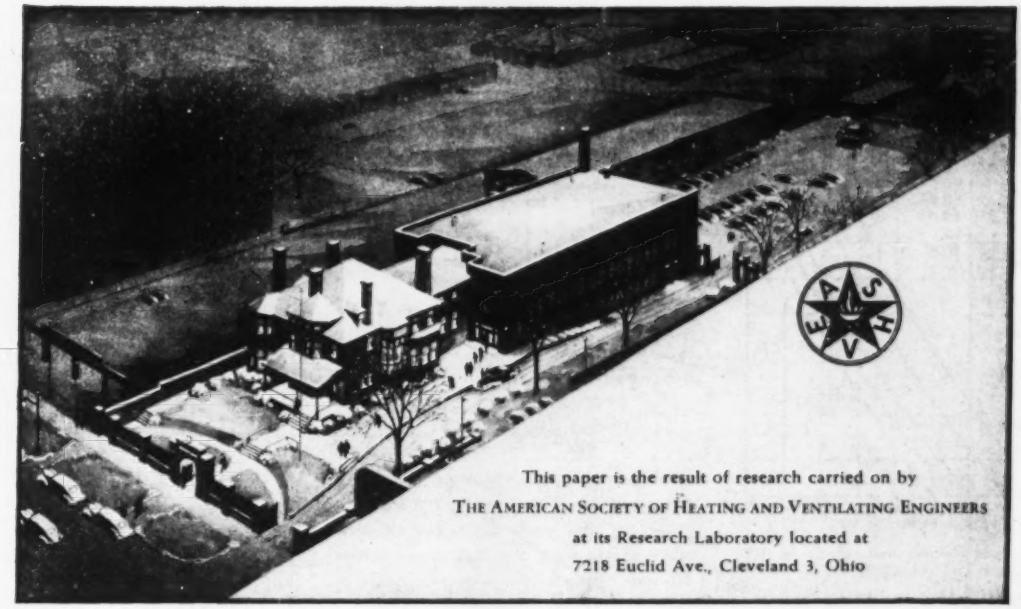
Mr. Parrott is a registered professional civil engineer in the State of Michigan.

R. J. TENKONOHY, Boyd E. Phelps, Inc., Michigan City, Ind., joined the Society in 1923. At the time of his joining, Mr. Tenkonohy was affiliated with the Pittsburgh Chapter. He later joined the St. Louis Chapter, serving in various chapter offices concluding with the presidency in 1939. Mr. Tenkonohy also served on the Society's Committee on Research from 1938-40.

R. J. Tenkonohy
Michigan City, Ind.

Born in Detroit, Mich., on January 22, 1888, he attended Michigan State College, graduating in 1912 with a B.S. in mechanical engineering. Mr. Tenkonohy was employed by American Blower Co. at Detroit and Pittsburgh in an engineering and sales capacity between 1912 and 1922. He then joined the staff of Skinner Bros. Mfg. Co., Inc. in St. Louis, which became Airtherm Mfg. Co., in the engineering, sales and management line. During World War II he was engaged in the design and specification of mechanical equipment of buildings with Charles W. Cole & Son of South Bend, Ind., and J. Gordon Turnbull, Inc., of Cleveland on shell-loading plants, synthetic rubber and tire plants.

Mr. Tenkonohy is a registered professional engineer in the States of Indiana and Missouri, and he is a member of Tau Beta Pi.


This paper is the result of research carried on by
THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
at its Research Laboratory located at
7218 Euclid Ave., Cleveland 3, Ohio

Heat Exchanges in a Floor Panel Heated Room

By L. F. Schutrum*, G. V. Parmelee**, and C. M. Humphreys†, Cleveland, Ohio

THIS PAPER is the second of a series dealing with heat exchanges within panel heated and cooled spaces, studies of which form part of the Society's long-range research program in panel heating and cooling. It describes the results of tests made in the ASHVE Environment Laboratory in which the *entire floor area* was the heating panel. Most of the tests were made with all parts of the ceiling and the walls at the same surface temperature (a so-called uniform environment), but some data are given for tests in which these surface temperatures differed from one another, *i.e.*, a non-uniform environment. Results are compared with those of previously reported tests in which the *entire ceiling area* was the heating panel.[1]

SUMMARY—This paper provides data on heat exchanges which occur in a floor panel heated room. A previous paper reported similar information for a room heated by a ceiling panel.

The effects of infiltration of air, at various rates and temperatures, upon heated panel output, room temperature, and heat flow through wall surfaces are shown for conditions of uniform unheated wall and ceiling temperatures. Comparisons are made to show the effects of non-uniform and uniform environments.

Test Apparatus

The ASHVE Environment Laboratory, equipped and instrumented for direct measurement of heat flow rates through all six surfaces of the room, has been described in a previous paper.[2] The interior surfaces of the room are made up of 75 aluminum panels of various sizes, arranged to provide maximum flexibility in surface temperature control. All room-side surfaces were painted with a semi-gloss gray paint.

Low-inertia, low-resistance heat flow meters, which also have been described previously,[3] cover approximately 10 percent of the inside surface area of the room, the nominal dimensions of which are 24 ft 6 in. by 12 ft with an 8-ft ceiling height.

Surface temperatures were measured by thermocouples cemented in grooves cut into the backs of the aluminum panels.

Air temperatures, measured by butt-soldered, 36-gage, copper-constantan thermocouples, were taken at six locations along two walls and at various levels in the center and near one end of the room.

Infiltration was recognized as an important factor affecting both room air temperatures and panel outputs. The infiltration air, introduced into the room by way of six vertical 2-in. diameter perforated pipes closed at the top, was metered by means of an orifice. Four of the six pipes were located along one long wall (east) and 2 along one short wall (south).

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†Senior Engineer, ASHVE Research Laboratory. Member of ASHVE.
[1]Exponent numerals refer to References.
Presented at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Denver, Colo., June 29-30, July 1, 1953.

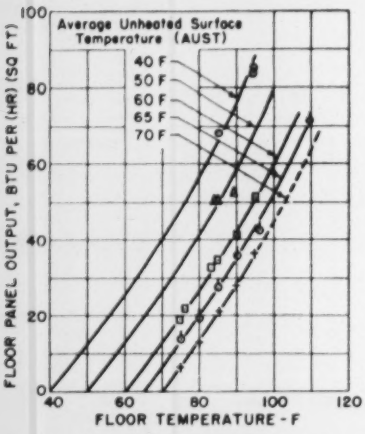

Fig. 1—Heat flow from the floor *vs.* floor temperature and AUST

(Uniform environment, no infiltration, 24½ x 12 x 8 ft high room)

Since it was felt desirable to define the manner of exit of this air as completely as possible, the room was fairly tightly sealed and the door cracks were taped. Under such conditions about 50 percent equivalent of the infiltration air left the room at the floor level through a 6-ft long slot, about 0.4 sq ft in area, in the center of the north half of the west wall. The air temperature was taken at this point. The remaining equivalent of 50 percent of the infiltration air undoubtedly left the room through small cracks between the panels forming the various room surfaces. In a normal house or building there is considerable uncertainty as to the actual entrance and exit temperatures of infiltrating air.

Test Procedure

All data covered by this report were taken under steady state conditions and mainly with a uniform environment. Panel temperatures and rates and temperatures of infiltration air were controlled; room air temperatures and heat flow rates were the dependent variables.

In this report the term *uniform environment* designates a condition wherein *all panels of the four walls and the ceiling were maintained at the same surface temperature.* The term *non-uniform environment* indicates a condition wherein *ceiling and wall surfaces were not at the same temperature.*

All of the tests described herein were made with the test room unoccupied, unlighted, and containing only the necessary instrumentation.

Calibration: The calibration of the individual heat flow meters and of the Environment Laboratory as a unit was described in a previous paper.[1] The calibrations of selected heat flow meters were checked at frequent intervals during the tests, a further check being maintained by comparing the metered heat inflow from the floor with the metered outflow through the walls and ceiling in those tests in which there was no infiltration. In 19 such tests these heat flows differed by less than 5 percent. In general, the measured heat inflow from the floor was lower than the total outflow through the other surfaces.

Table 1—Heat Flow Distribution for Uniform Environment with No Infiltration

Test No. 94 (AUST: 65.0 F); Air Temperature at Center of Room: 71.8 F at 30-in. level; 71.5 F at 60-in. level

Col. 1 Surface	Col. 2 Surface Temp F	Col. 3 Total Heat Flow Btu/hr	Col. 4 Percentage of Floor Heat Flow	Col. 5 Heat Flow Rate Btu/(hr) (sq ft)
Floor	84.7	8385	100.0	27.9
Ceiling	64.9	3615	43.1	12.0
North Wall (incl. door)	66.4	570	6.8	6.0
South Wall	64.7	785	9.4	8.2
East Wall	64.7	1605	19.1	8.2
West Wall	64.8	1915	22.8	9.8
Total (Walls and Ceiling)		8490	101.2	

Test Results — Uniform Environment

Heat Flow — No Infiltration

Fig. 1 shows the heat output from the upper surface of the floor panel for conditions of uniform environment, no infiltration air, and the room empty and unlighted, as a function of the floor panel temperature and the area weighted average temperature of the unheated surfaces of the room. This *average unheated surface temperature* is abbreviated AUST. The heat transfer coefficient for radiation and convection combined, based upon the difference between floor temperature and AUST, is about 1.4 Btu per (hr) (sq ft) (F deg) for the range covered in Fig. 1.

A comparison of the heat outputs from this floor panel and from a ceiling panel in the same room yields interesting data. For an AUST of 65 F and a panel surface temperature of 85 F, the floor panel output was approximately 27 Btu per (hr) (sq ft) (see Fig. 1) as compared with a ceiling panel output of 20 Btu (per hr) (sq ft) (see Reference 1). The difference is the increase in convective heat transfer from the floor panel.

Table 1 shows the distribution of heat flow through the cooled surfaces of the room. These data are typical of the tests made without infiltration. It was found that the calculated radiant energy exchanges between the floor and each of the other room surfaces, expressed as percentages of the sum of these calculated radiant exchanges, were substantially the same as the percentages of total heat exchange shown in Column 4 of Table 1. These percentages are practically the same as those reported for the heated ceiling tests.[1] Note also that the total observed heat flow into the room differed from the observed outflow through the walls and ceiling by 1.2 percent.

The variation in heat transfer through individual room surfaces is illustrated in Fig. 2 which shows the heat flow rate at each heat flow meter location for the south half of the Environment Laboratory. The heat flow rates through the lower parts of the walls are greater than those through the upper parts because of the difference in position with respect to the heated panel.

Heat Flow — With Infiltration

Fig. 3 shows the effect of the rate of infiltration on the heat flow through each surface. All surface temperatures and the infiltration air

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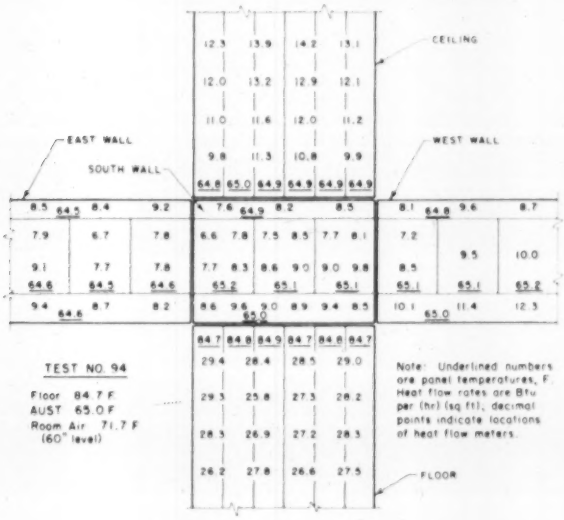
CEILING
EAST WALL
WEST WALL
SOUTH WALL
FLOOR
TEST NO. 94
Floor 84.7 F
AUST 65.0 F
Room Air 71.7 F
(60" level)
Note: Underlined numbers are panel temperatures, F. Heat flow rates are Btu per (hr) (sq ft), decimal points indicate locations of heat flow meters.

Fig. 2—Heat flow and temperature distribution for south half of Environment Laboratory
(Uniform environment, no infiltration, 24½ x 12 x 8 ft high room)

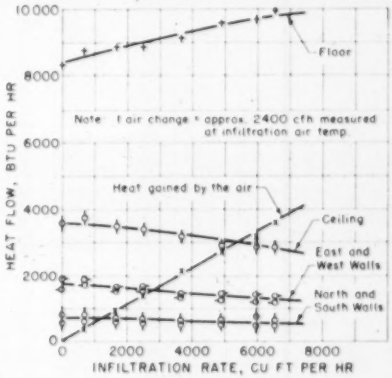
HEAT FLOW, BTU PER HR
INFILTRATION RATE, CU FT PER HR
Floor
Note: 1 air change = approx. 2400 cfh measured at infiltration air temp.
Heat gained by the air
Ceiling
East and West Walls
North and South Walls

Fig. 3—Effect of infiltration rate on heat flow
(Floor at 85 F, all other surfaces at 65 F; 40 F infiltration air temperature; 24½ x 12 x 8 ft high room)

temperature were held constant. It will be seen that as the rate of infiltration increased, the heat output of the panel increased, while the heat outflow through the other five (cooled) surfaces decreased. These changes are the result of the combined effect of a decrease in room air temperature and an increase in convection conductances.

Table 2 gives the heat flow through each surface of the room for one of the tests shown in Fig. 3. Surface temperatures were essentially the same as those in Table 1, for a test without infiltration.

Fig. 4 shows the additional heat output from the floor due to infiltration air in terms of the infiltration air rate and temperature and of the AUST. These values, added to the appropriate values from Fig. 1, give the total output of the floor panel when there is infiltration into the room.

Heat Transfer to the Air

With no infiltration, the room air temperature is established by a heat balance between the convective heat gain from the surfaces warmer than the air and the convective heat losses to the colder surfaces. Radiation absorption by gases and water vapor in the air also enters into this balance. Nevertheless, the net heat gain by the room air is zero under steady state conditions. With infiltration, however, some heat is required to warm the incoming air and this heat is removed from the room by the exfiltrating air. This heat quantity is termed *heat gain by infiltration air* for the remainder of this paper.

The heat gain by the infiltration air is found from the following energy balance:

$$\text{Heat input from floor} = \text{Net heat outflow through other surfaces} + \text{Heat gain by the infiltration air} \quad \ldots (1)$$

The satisfactory heat balances obtained in the tests with no infiltration indicate that the heat gain by the air could be obtained from the above equation with adequate accuracy. The data given in Table 2 were determined in this way.

The temperature of all the air leaving the room could not be measured directly. Approximately half of it left through the slot where temperature was measured.

Calculations based upon the heat gain by infiltration air as determined by the method described above showed that the average temperature of the exfiltration air was practically equal to the average of the exit air temperature measured at the slot and the area weighted average temperature of all room surfaces (hereafter referred to as the AST). For these tests, then, the heat gain by the air can be related to the controlled variables: room surface temperature, infiltration air rate and temperature. This relationship is shown in Fig. 5.

The Effect of Point of Entrance and Exit of Infiltration Air

As previously described, the infiltration air normally entered the room at four points along one long wall (east) and at two points along one short wall (south). About 50 percent of this air left the room by way of an exit slot in the floor adjacent to and centered along the north half of the west wall. In a series of tests in which surface temperatures and infiltration air temperatures were held constant, the points of air supply were varied, the infiltration rate being maintained at 1-½ air changes. First, only the two supply points along the south wall were used, thus giving a long flow path to the exit slot. The flow path was then shortened by using only the two supply points centered on the north half of the east wall.

These two variations of the infiltration points of entrance had no sig-

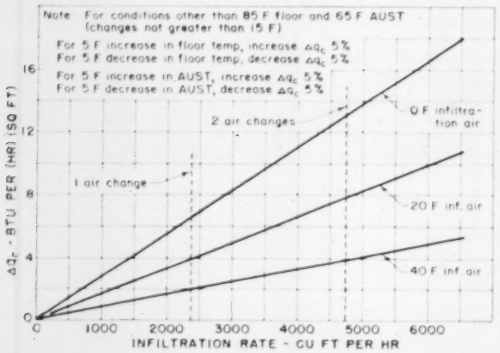
Note: For conditions other than 85 F floor and 65 F AUST (changes not greater than 15 F)
For 5 F increase in floor temp, increase Δq, 5%
For 5 F decrease in floor temp, decrease Δq, 5%
For 5 F increase in AUST, increase Δq, 5%
For 5 F decrease in AUST, decrease Δq, 5%
2 air changes
0 F infiltration air
1 air change
20 F inf. air
40 F inf. air
Δq - BTU PER (HR) (SQ FT)
INFILTRATION RATE - CU FT PER HR

Fig. 4—Additional heat output from floor due to infiltration air
(Floor 85 F, all other surfaces 65 F; 24½ x 12 x 8 ft high room)

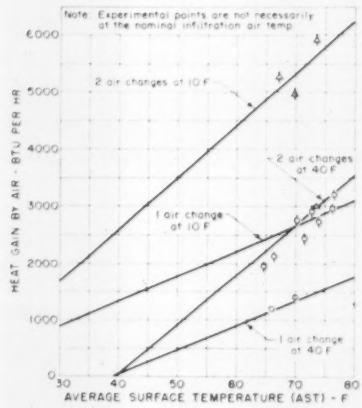
Note: Experimental points are not necessarily at the nominal infiltration air temp
2 air changes at 10 F
2 air changes at 40 F
1 air change at 10 F
1 air change at 40 F
HEAT GAIN BY AIR - BTU PER HR
AVERAGE SURFACE TEMPERATURE (AST) - F

Fig. 5—Heat gain by infiltration air
(Uniform environment, 24½ x 12 x 8 ft high room)

nificant effect upon the heat flow from the floor panel nor on the room air temperature at the 30-in. and 60-in. levels (center of room). The heat gained by the infiltration air, however, was slightly higher than normal when the long air-flow path was used and slightly lower when the short path was used.

In other tests the room was tightly sealed so that all the air left by means of the exit slot. This was checked by actual measurement. In these tests all six infiltration entrance points were used. The heat flow from the floor panel, the room air temperature, and the heat gained by the infiltration air showed that no significant changes resulted from sealing the room surfaces against air leakage. With this arrangement a complete energy balance could be made for the tests with infiltration as well as for those without infiltration.

Room Air Temperature — No Infiltration

The room air temperature gradient from the floor to the ceiling at the center of the room is shown in Fig. 6. The dimensionless abscissa scale generalizes the use of this curve, which shows the average values for 23 tests. With this dimensionless coordinate the room air temperature at any level can be found from the equation:

$$\text{Room air temperature} = (\text{A constant})(\text{floor temp minus AUST}) + \text{AUST} \quad (2)$$

The constant varies with height in accordance with the curve. For example, the constant is 0.32 for the 60-in. level. The maximum deviation of the experimental data from the curve was about 5 percent for the 12-in. and higher levels and about 10 percent for levels below 12 in. The second abscissa scale shows the variation in room air temperature with height for the specific conditions of 65 F AUST and 85 F floor temperature.

Fig. 7, which shows the room air temperature at the 60-in. level *vs* floor temperature and AUST, was plotted by means of Equation 2.

Room Air Temperature — With Infiltration

Infiltration caused the room air temperature at the 60-in. level (center of room) to decrease in the manner shown in Fig. 8 for the given conditions. As expected, the room air temperature decreased as the infiltration air temperature decreased and the infiltration rate increased.

The room air temperature gradients for tests with infiltration are compared in Fig. 9 with the average no-infiltration curve of Fig. 6. The infiltration air-flow rate and temperature were the only controlled variables which were changed in this series of tests. Test No. 130 (Fig. 9) showed a marked reduction in air temperature when two air changes at 39.2 F were introduced. A still lower room air temperature resulted when the infiltration air temperature was reduced to 21.6 F as shown by test No. 129.

Fig. 10, based on data from 19 tests, shows the reduction in room air temperature at the 60-in. level (center of room) due to infiltration air. The greatest deviation between

Table 2—Heat Flow Distribution for Uniform Environment with Infiltration of Two Air Changes at 39.2 F

Test No. 130 (AUST: 65.1 F); Air Temperature at Center of Room: 68.4 F at 30-in. level; 68.3 F at 60-in. level; Air Temperature at Exit Slot: 69.2 F

Col. 1 Surface	Col. 2 Surface Temp F	Col. 3 Total Heat Flow Btu/hr	Col. 4 Percentage of Floor Heat Flow	Col. 5 Heat Flow Rate Btu/(hr) (sq ft)
Floor	84.7	9605	100.0	31.9
Ceiling	65.2	2870	29.9	9.5
North Wall (incl. door)	66.2	500	5.2	5.2
South Wall	64.8	625	6.5	6.5
East Wall	65.0	1265	13.2	6.5
West Wall	64.7	1460	15.2	7.4
Heat Gain by Air by difference		2885	30.0	

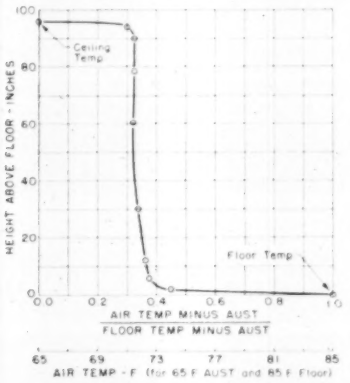
HEIGHT ABOVE FLOOR - INCHES
Ceiling Temp
Floor Temp
AIR TEMP MINUS AUST
FLOOR TEMP MINUS AUST
AIR TEMP - F (for 65 F AUST and 85 F Floor)

Fig. 6—Floor to ceiling temperature distribution at the center of room *(Heated floor, uniform environment, no infiltration,* 24½ x 12 x 8 *ft high room)*

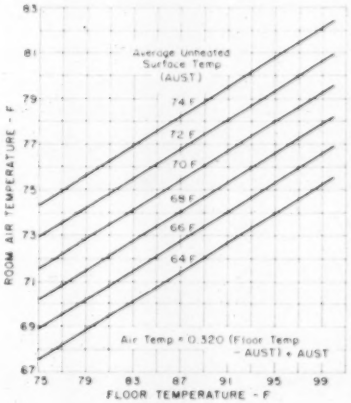

Fig. 7—Air temperature at 60-in. level, center of room, *vs.* floor temperature and AUST *(Uniform environment, no infiltration,* 24½ x 12 x 8 *ft high room)*

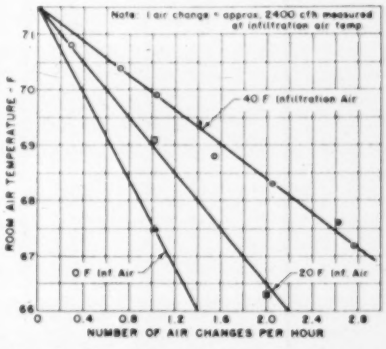
Note: 1 air change = approx. 2400 cfh measured at infiltration air temp.
40 F Infiltration Air
0 F Inf Air
20 F Inf Air
ROOM AIR TEMPERATURE - F
NUMBER OF AIR CHANGES PER HOUR

Fig. 8—The effect of infiltration air rate and temperature on room air temperature *(Room air temperature taken at 60-in. level, center of room; floor* 85 *F; all other surfaces* 65 *F;* 24½ x 12 x 8 *ft high room)*

experimentally determined values and those determined by combining the curves of Fig. 7 and the values of Fig. 10 was 1.1 F deg.

The Effect of Average Wall and Ceiling Conductance

Let the conductance C' be defined as a total heat flow through a wall divided by the product of the area of the wall and the temperature difference between the indoor surface of the wall and the outdoor air. Then the cooled surface of the test room can represent an actual exposed wall whose average conductance, for a given heat flow rate, depends on the value assigned to the difference between the temperatures of the indoor surface and the outdoor air. For example, a heat flow rate of 10 Btu per (hr) (sq ft) and a surface temperature of 65 F could represent combinations of conductance and outside air temperature respectively of 0.5 Btu per (hr) (sq ft) (F deg) and 45.0 F, 0.20 and 15 F, or any combination in which the product of conductance and temperature difference equaled 10 Btu per (hr) (sq ft).

The effect of an average conductance on the AUST and on the floor temperature and heat flow required to maintain an air temperature of 70 F at the 60-in. level (center of room) is shown in Fig. 11 for conditions of 0 F, outside air and one air change, based upon the air density at 0 F. Note that for values of C' greater than about 0.05 the AUST is below 70 F and heat flow is from the air to the walls. For values of C' less than 0.05 the opposite is true. *It is important to realize that Fig. 11 applies only to the room and to the conditions noted.*

Test Results — Non-Uniform Environment

Tests were made with various combinations of ceiling and wall temperatures to explore the performance of the floor panel with a non-uniform temperature environment. The results are shown in Table 3. Columns 2 to 7 in the table describe the non-uniform experimental conditions.

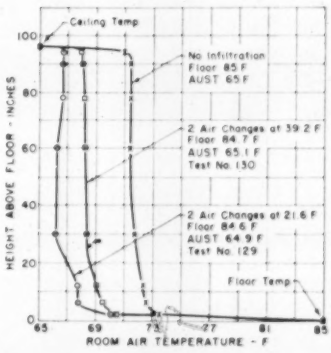

Fig. 9—The effect of infiltration on floor to ceiling temperature distribution at the center of the room *(Uniform environment,* 24½ x 12 x 8 *ft high room)*

In columns 8 and 9 the panel heat output for the particular test is compared with the value which would have been obtained in the room with the same AUST and floor temperature but with a uniform environment (see Figs. 1 and 4). In all the tests the panel output for a non-uniform environment was greater than that for the uniform environment.

The last four columns of Table 3 compare measured room-air temperatures for the non-uniform environment tests with calculated temperatures for a uniform environment for the same AUST, panel temperature and infiltration conditions (see Figs. 7 and 10). The data show that the non-uniform environments had little effect on room air temperature.

The heat gain by the infiltration air for the non-uniform environment tests with infiltration (Nos. 172 and 175) averaged about 10 percent higher than the gain for the comparable uniform temperature conditions.

Conclusions

It is recognized that most of the experimental work described in this paper was carried out under conditions seldom, if ever, encountered in normal practice, *i.e.*, the room unfurnished and unoccupied, all parts of the ceiling and walls at the same surface temperature, and the entire floor area heated to a uniform temperature. However, tests of this type are considered essential for the de-

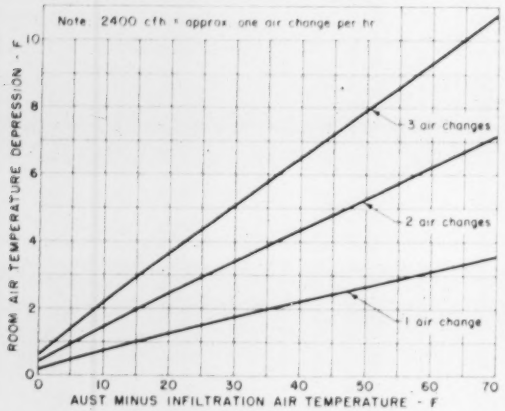
Note: 2400 cfh = approx. one air change per hr
ROOM AIR TEMPERATURE DEPRESSION - F
AUST MINUS INFILTRATION AIR TEMPERATURE - F
3 air changes
2 air changes
1 air change

Fig. 10—Decrease in room air temperature at the 60-in. level, center of room, with infiltration
(Uniform environment, 24½ x 12 x 8 ft high room)

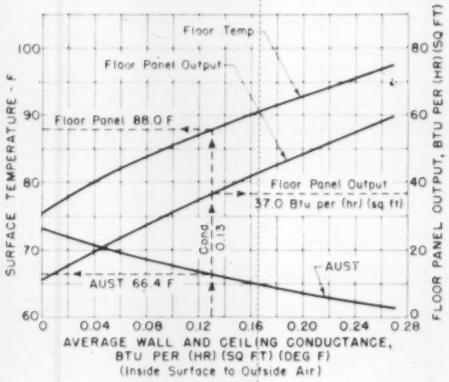
Floor Temp
Floor Panel Output
Floor Panel 88.0 F
Floor Panel Output
37.0 Btu per (hr) (sq ft)
Cond 0.13
AUST
AUST 66.4 F
SURFACE TEMPERATURE - F
FLOOR PANEL OUTPUT, BTU PER (HR) (SQ FT)
AVERAGE WALL AND CEILING CONDUCTANCE, BTU PER (HR) (SQ FT) (DEG F)
(Inside Surface to Outside Air)

Fig. 11—The effect of average wall and ceiling conductance on the AUST and on the floor temperature and heat output required to maintain 70 F room air temperature at the 60-in. level
(0 F outside temperature, one air change at 0 F, 24½ x 12 x 8 ft high room)

velopment of basic information, to be used with data from tests which are now being made under conditions more nearly representative of practical operating conditions for floor and ceiling-panel heated rooms.

It should be remembered that the method given in the HEATING, VENTILATING, AIR CONDITIONING GUIDE for determining the required panel temperature for a floor or ceiling panel uses a procedure in which the average unheated surface temperature (AUST) of the room is calculated and the temperature of the panel determined from charts in which the AUST is one parameter and the required panel output the other. In other words, the equivalent of a uniform environment is established by calculation, and panel performance is related thereto. To this extent the data developed in these studies and presented here are applicable for design purposes.

However, other variables may influence panel output and room air temperature. In the tests under way as this paper is written, the effects of furnishings, lights, and floor coverings are being studied, not only under conditions of uniform environment, but also under various non-uniform conditions, one of which, for example, incorporates two simulated outside walls in which there are three simulated windows.

While limitations, imposed by the conditions under which the tests were made, are recognized, the following observations are justified:

1. Pending the establishment of data on the radiative and convective components of the total heat output from floor panels, studies of which are currently under way, the values for total panel output obtained in these tests indicate that the values given in THE GUIDE 1952 (Fig. 11, p. 548,) are of the right order of magnitude for unheated mean radiant temperature (UMRT) values of around 65 F.

2. Room air temperatures were found to be higher for a floor panel heated room than for a ceiling panel heated room for the same room surface temperatures. For example, with an 85 F panel temperature and a 70 F AUST, with no infiltration, the room air temperature at the 60-in. level would be 74.8 F with a floor panel, and 71.2 F with a ceiling panel.

3. The effect on the room air temperature at the 60-in. level of varying the amount of infiltration air and its entering temperature was about the same in the floor panel tests (see Fig. 10 this paper) as it was shown to be in the ceiling panel tests (see Fig. 9, Reference 1).

4. In none of the tests reported on here did the air temperature gradient in the room between the 2-in. and the 90-in. level exceed 3.5 F deg.

Table 3—The Effect of Non-Uniform Environment on Floor Heat Output and on Room Air Temperature

Test No.	Surface Temperature, F				Infiltration Air		Floor Heat Output Btu/(hr) (sq ft)		Room Air Temperature Center of Room, F			
	Floor	Glass (East Wall)	All Other Surfaces	AUST	Changes Per hr	Temp F	Non-Uniform Conditions Test Values	Uniform Conditions Calculated Values	Non-Uniform Conditions Test Values		Uniform Conditions Calculated Values	
									30-in.	60-in.	30-in.	60-in.
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13
164	84.6	45.3	65.2	60.8	None		55.2	52.8	68.4	68.4	68.8	68.4
167	85.3	36.2	64.5	58.1			59.3	57.2	66.7	66.7	67.3	66.8
171	84.5	36.0	69.4	62.5			54.2	50.5	69.4	69.6	70.0	69.6
170	84.8	35.8	74.4	65.9			29.7	26.5	72.5	72.8	72.3	72.0
168	84.6	26.0	65.0	56.4			45.6	39.5	65.2	65.2	65.9	65.4
165	75.1	45.9	65.0	60.7			20.6	18.8	65.3	65.3	65.6	65.3
166	74.8	36.3	64.4	58.3			24.4	22.2	63.5	63.7	63.9	63.6
169	75.3	26.4	65.3	56.8			29.9	24.5	62.2	62.5	63.0	62.7
175	84.7	45.6	70.0	64.7	2	40	54.1	51.6	66.9	67.9	68.2	68.2
174	85.2	45.6	70.4	64.8	1	40	32.9	29.5	70.0	70.0	70.1	69.8
172	84.7	36.1	69.2	62.0	1	40	37.4	32.9	68.1	68.1	68.2	67.9
173	84.9	36.2	70.1	62.8	1	zero	40.6	36.8	64.8	66.7	66.8	66.7

References

1. Heat Exchanges in a Ceiling Panel Heated Room, by L. F. Schutrum, G. V. Parmelee, and C. M. Humphreys (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, December 1952, p. 123).

2. The ASHVE Environment Laboratory, by Cyril Tasker, C. M. Humphreys, G. V. Parmelee, and L. F. Schutrum (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, March 1952, p. 119).

3. A Low-Inertia Low-Resistance Heat Flow Meter, by R. G. Huebscher, L. F. Schutrum, and G. V. Parmelee (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, May 1952, p. 111).

Experimental Approaches to the Study of Noise and Noise Transmission in Piping Systems

By W. L. Rogers*, Evanston, Ill.

This paper is the result of research sponsored by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS in cooperation with Northwestern University, Evanston, Ill.

SUMMARY—For many years there has been a lack of knowledge concerning the generation and transmission of noise in water piping and heating systems, as these are related to water velocity, water temperature, pressure, pipe size, design configuration and pump vibration. This research was inaugurated to study the relationships of the variables involved and to discover and evaluate methods by which noise levels can be reduced. This paper is a progress report on the project, and covers the initial planning and the experimental set-up which has been constructed to carry out the investigations.

Preliminary Considerations

THE SUBJECT of the generation and transmission of noise in water piping and heating systems is an item of vital concern in the heating and plumbing industries. Because of the need for more knowledge on the subject, THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS has sponsored a project in cooperation with Northwestern University to study the problems involved. The first step involved the design and construction of the experimental equipment in which the variables could be controlled. It was planned to investigate the noise characteristics of straight runs of pipe, of pipe fittings and finally to allow for the insertion of pumps so that their noises could be studied and superimposed on various piping arrangements.

This paper describes the experimental set-up and instrumentation which are being used, with mention of some of the problems encountered and the adjustments and changes made to effect the desired control and measurement. Before the final form of the experimental set-up could be established definitely, it was necessary to spend some time in preliminary study and experimentation. The first requirement of the basic system involved control of water pressure, temperature, and velocity in the piping components under test. Further, it was necessary to recognize that any acoustic disturbances originating in the water upstream or downstream from the test components could be carried into the test region both by the liquid and by pipe-wall vibration. In other words, noises other than those generated by the pipe or fitting being tested were to be eliminated as far as possible.

This required the elimination of all pumps for the series of tests involving only the noises arising from flow through pipes and fittings, and posed problems of controlling flow rates and pressures. If noise sources, such as control valves, could not be completely eliminated, then it was necessary to consider means of blocking their noises from reaching the test region. It was also necessary to suspend the test pipes and fittings in a manner which would exclude building vibration from reaching them.

In early experiments, cold water from the city supply lines was fed to a 20-foot length of 1-in. pipe. Several feet of soft rubber hose without cord plies were inserted both before and after the test pipe. The hose was used to damp out pressure fluctuations (sounds) in the water which arose from flow through upstream and downstream control valves and other possible pipe-fitting noise sources. The hose also prevented supply and discharge pipe-wall vibration from reaching the test section. Isolation from building vibration was achieved by suspending the pipe from rubber loops.

Under certain conditions, audible noises were generated by flow through control valves, elbows, and the orifice which was used to indicate the water flow rate.

At this time, it was contemplated that air-borne sound would be measured by means of a microphone

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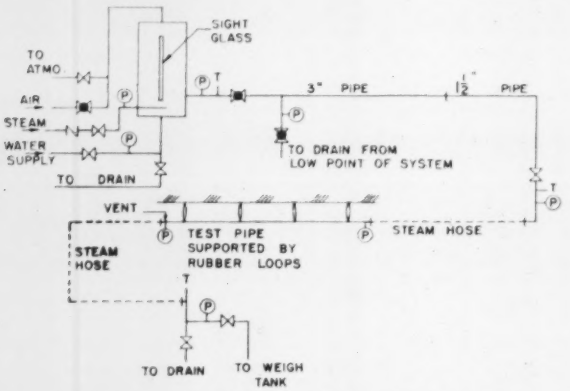

Fig. 1—Diagram of the experimental piping arrangement

placed near the fitting or pipe under test.

The room used for these investigations is an air-conditioning test room with heavy walls lined on the inside with 6-in. cork and faced with cement plaster. The room does screen out much sound, but it was found necessary to operate at night in order that the sound level in the room be low enough for detection of some of the weaker sounds which were generated by flow. Also, the air-borne noises from control valves and the orifice often were louder than the noises from the component under test.

On the basis of the preliminary tests, it was decided that most of the controls should be located outside the test room, if possible, and that the orifice which had been used as a flow-rate indicator should be eliminated. It was further decided to consider other measurement techniques, such as the measurement of pipe-wall vibration and of sound-pressure fluctuations in the flowing stream.

It was necessary to decide upon means for controlling water pressure and temperature in the test section. Pumps were undesirable because noise generated by them might be transmitted into the test region and thus it was decided to use a large tank with controlled air pressure on the water surface as the water supply. For operation at elevated temperatures, heating is accomplished by passing steam directly into the water.

Experimental Set-Up

Fig. 1 is a schematic diagram of the present test set-up. Water is supplied to the test region from a large tank 4 ft in diameter and 8 ft high, with a capacity of approximately 750 gal. Desired temperatures are obtained by injecting steam into the water. Desired pressures are produced by the admission of compressed air to the tank above the water surface.

The feed line from the tank to the test region is composed of approximately 20 ft of 3-in. pipe, followed by 35 ft of 1½-in. pipe, and finally by 20 ft of steam hose.

The basic test section length is 20 ft with the pipe elastically supported at four points by rubber loops. For testing fittings, the pipe is broken at the middle so that there is a 10 ft section of pipe both before and after the fitting. The system can accommodate test pipe and fitting sizes from ½-in. to 1½-in. The arrangement can be supported in a live sound chamber so that air-borne sound measurements can be made, or it can be supported outside the chamber where it is more convenient to measure pipe-wall vibration. Special care has been used in reducing the outer diameter of the inlet and outlet ends of the test pipe so that the steam hose fits snugly over the pipe ends, without abrupt change in section at these locations.

The outlet line from the test region is composed of approximately 50 ft of steam hose and discharges into a 3-in. waste drain line. The water is not recirculated.

Operation of Test Equipment

Before discussing the sound instrumentation, the manner of operation of the test equipment will be explained. A batch process is involved. The tank is first partially filled with water from the city supply lines. Then live steam is passed into the water until the desired temperature is reached. The steam is shut off, and compressed air from a supply reservoir is then admitted to the tank space above the water until the tank pressure is somewhat above the desired pressure at the test region. The system is then ready for a run.

Two valves, one after the tank outlet and the other at the final discharge to drain, can be used to control pressure and flow rate (velocity) in the test region. These valves are placed as far as possible from the test region, and connections to the test pipe are of flexible hose, as previously mentioned. In a test run, the two control valves are adjusted to give the desired pressure and flow rate. Then, with the final drain valve setting locked, manual control of the tank discharge valve is used to maintain the desired pressure and flow rate in the test section. The tank valve is opened gradually as the water level in the tank recedes and the air above the water expands. It is possible to add additional air very quickly if the air pressure in the tank drops to too low a value to maintain desired pressure in the test region. A run is terminated when the water supply in the tank is exhausted.

The tank is located in a room separated from the room enclosing the test section. A gage glass on the side of the tank allows observation of the water level inside for timing the volumetric flow rate. Fig. 2 shows the test section illustrating the method of hanging the pipe, and some of the instrumentation. Water enters the room from below, rising in the pipe near the middle of the test section. The water is led

through steam hose and then enters the test pipe from the left in the picture. At the far side of the test pipe, steam hose carries the water away through the floor, where it discharges to drain in a different room below. Thus both the supply tank and drain region are in rooms separated from the test room.

Runs of about 20 min duration can be made with a velocity up to 10 ft per second in 1-in. pipe, and proportionate times for other sizes and for other rates. Runs have been made with water temperatures as high as 250 F and with velocities above 10 fps in 1-in. pipe. Pressure in the test region has been maintained in the 15-30 psig range. Pressure gages and thermometers are used to indicate pressures and temperatures of water in the test region.

Measuring Water Flow:

Several methods of measuring the rate of water flow were considered. It was at first deemed desirable to have an instantaneous reading indicating the flow rate, as was previously mentioned, and calibrated orifices were inserted in the pipe line leading from the test region to drain.

In exploratory runs it was found that under some conditions flow through the orifice plates caused intense noise generation which could be heard clearly (by stethoscope) in the pipe at the test location. Consequently, it was decided to eliminate the orifices and measure the flow rate by timing the weight of water finally discharged or by timing the volume decrease of water in the tank. The latter method was adopted.

Pressure Drop at Discharge Valve:

Another problem was created from the sudden pressure drop of hot water through the valve at the final discharge to drain. Noises generated there were transmitted in large measure back to the test region when an insufficient length of rubber hose existed between the test pipe and the drain valve. Considerable experimentation was necessary to determine what length and size of hose should be used to give effective sound attenuation, without necessitating excessive pressures in the test region during test runs. Another factor involved was the attempt to eliminate the sudden pressure drop at the drain valve, and to substitute the graduated pressure drop which occurs in the discharge rubber hose. More rapid pressure drop gradients seem to generate excessive noise. An effective compromise has been found through adjustment of the length and size of steam hose now being used between the test pipe and the final drain valve.

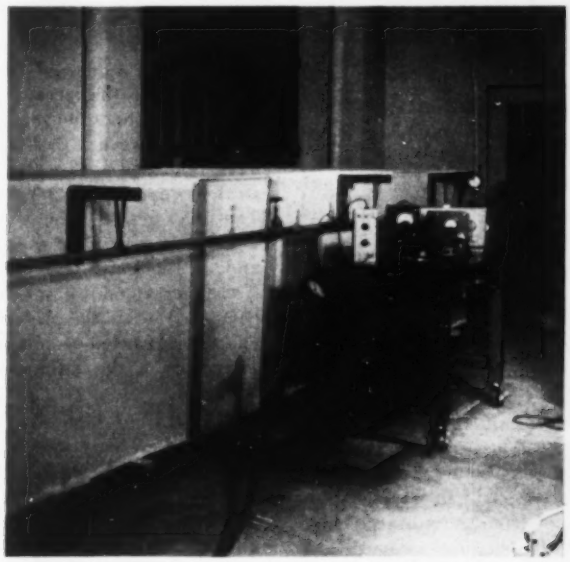

Fig. 2—The test-section of pipe and some of the instrumentation
A valve under test is shown at the middle of the pipe

The problem of keeping the feed water to the test section relatively free of acoustic disturbances has been mentioned briefly. It will be noted that no pumps are operating during a test run; further, only two valves are used to control pressures and flow rates, and these valves are placed as far from the test location as possible. The lengths of rubber hose used between the valves and the test section contribute to sound attenuation by a pressure-relief and damping effect.

If pressure pulsations (sound waves) reach a location where there is relative freedom of expansion, then a weakened sound wave travelling at reduced velocity leaves the locality. High-frequency pulses are damped out more readily and more rapidly than those of low frequency by the effect obtained in rubber hose. For cold-water runs, soft rubber tubing with no cord insert was found to be very effective in blocking upstream and downstream sounds from the test pipe. For hot-water runs, however, safety dictated the use of steam hose which has several plies of cord. This type of hose is much stiffer than the soft tubing and is less effective in attenuating sound. To offset this, many more feet of the steam hose are now used than were necessary for the soft tubing.

Instrumentation for Sound

When sound instrumentation is considered, it must be realized that the vibrations (sounds) produced by the piping components being tested can appear either as fluid-borne or as structural-borne vibration. Part of the sound energy causes the walls of the pipe and fitting to vibrate, and this structural vibration, which is readily transmitted by the structural components, produces air-borne noise. The remainder of the sound energy remains in the liquid and is transmitted in the liquid to other

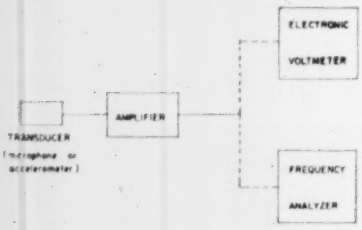

Fig. 3—Simplified diagram of the instrumentation

regions where it might eventually become air-borne.

There is relatively little attenuation of sound as it travels in the water inside metal pipes and so the sounds may be transmitted long distances without severe loss of energy. Both aspects of the sound transmission are of interest — the immediately air-borne sound from the vibrating pipe walls, and the *potential* air-borne and wall-vibrating sound which is carried within as well as along the pipe.

Some of the preliminary measurements of the air-borne sound were made with a microphone placed inside a live sound chamber enclosing the test pipe. In operation, the sound level with no flow was determined, then a 20 ft straight run of pipe was tested and finally various fittings were introduced. A practical difficulty was the attainment of a low enough ambient sound level to permit accurate measurement of weak sounds, as well as other difficulties associated with the frequency characteristics of such a hard-surfaced chamber.

It was decided to try a different approach to the measurement problem. The present system utilizes an accelerometer mounted on the pipe to indicate pipe-wall vibration, and a microphone mounted through the pipe wall in contact with the flowing stream. The reading taken from the accelerometer serves as an indication of air-borne sound (and also structural-borne vibration). The positioning of the vibration pickup (accelerometer) presents a problem, and it is necessary to adopt a composite average of the vibration recorded for various positions of the pickup along the pipe.

The sound level remaining in the water is measured by means of a microphone mounted through the pipe wall into the flowing stream. It must be recognized that the obstruction into the stream may result in sound generation at the microphone. However, preliminary tests have indicated that water flow in a straight pipe run is relatively quiet. The microphone mounting position is fixed in a straight run, therefore, and a reference level is obtained. Noise generated by fittings is then compared with this reference level, and the relative noise-producing characteristics of the fittings can be determined.

The straight pipe run is used as the basic reference level above which both microphone and accelerometer readings produced by fitting noises are measured and compared. The microphone being used is equipped with a DKT (di-potassium tartrate) crystal which exhibits no electrical conductivity as temperature is raised, making the microphone characteristics substantially independent of the temperature up to the maximum permissible operating temperature. For some other common materials, the lower cut-off frequency is raised appreciably as temperature is increased, whereas the DKT microphone has a lower cut-off frequency below 1 cps at all temperatures. It is reported that the maximum permissible temperature of the DKT microphone is limited to approximately 160 F. It is hoped that a correlation can be established between sound level in the water and pipe-wall vibration or air-borne sound level in the sound chamber. Such a correlation could allow extrapolation to higher temperatures at which the underwater microphone could not be used.

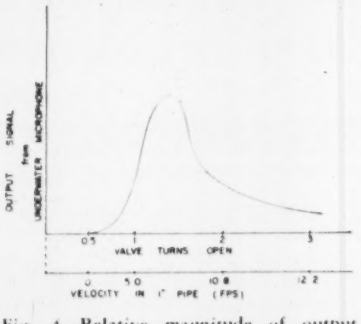

Fig. 4—Relative magnitude of output signal from underwater microphone as a function of valve opening
One-inch gate valve controlling flow. Constant pressure before valve = 22 psig, temperature = 40-70 F

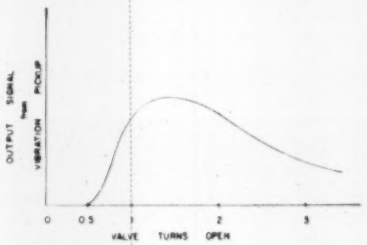

Fig. 5—Relative magnitude of output signal from pipe-wall vibration pickup as a function of valve opening
One-inch gate valve controlling flow. Constant pressure before valve = 26 psig, temperature = 55 F

The frequency ranges of both accelerometer and microphone extend to above 10,000 cps. In the testing procedure, frequency analyses are made of the signals from the accelerometer and microphone, in addition to the measurements of magnitudes. Fig. 3 indicates the wiring arrangement of the basic instrumentation.

Test Data

Samples of the *types* of data which have been obtained in experimental tests are shown in the accompanying curves. Relative values have been used for the ordinates in presenting these figures.

Fig. 4 illustrates the variation in output signal of the underwater microphone when noises were produced by a 1-in. gate valve as it was used to control water flow. The microphone was placed approximately 3 in. downstream from the valve. Upstream pressure (before the valve) was kept the same for all runs. The microphone position was probably close to a region of intense cavitation. The rise and fall of the output signal corresponded roughly with the audible sounds heard. In another run, the microphone was moved to a position 11 in. downstream from the valve. The curve obtained was practically the same as for the original microphone location.

Fig. 5 shows the pipe-wall vibration for a test similar to that of

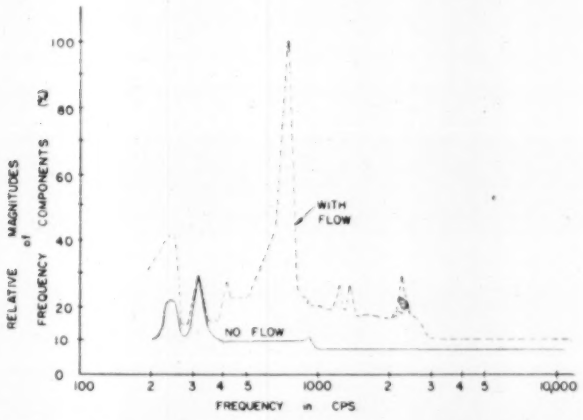

Fig. 6—Relative magnitudes of frequency components of signal from vibration pickup.
Constant setting of one-inch gate valve at approximately ¼ turn open. Constant velocity of 1.2 fps in one-inch supply pipe. Pressure before valve = 26 psig, temperature = 56 F

Fig. 4. For this test, a vibration pickup was placed approximately 1 ft upstream from the valve. The curve shows the same general characteristic pattern as Fig. 4.

Fig. 6 shows the results of a sample run with constant valve setting and constant flow rate. A frequency analysis was made from the signal produced by a vibration pickup located approximately 1 ft upstream from the valve. A particularly strong and rather sharply-peaked component is evident for the particular conditions of this run. The no-flow analysis to establish a datum is also shown.

Discussion and Conclusions

The experimentation to date has been largely of a qualitative nature, mainly concerned with the preliminary testing associated with adjustment of the experimental equipment to give desired operating conditions, and with the determination of proper instrumentation. Although quantitative information is not available at this time, a few generalized conclusions may be of interest.

Cavitation is an important factor, as might be expected. In localized regions of high velocity and low pressure, bubbles of vapor form (or bubbles of gas are released), giving rise to hissing sounds. Straight runs of pipe do not appear to contribute significantly to the production of noise. The preliminary tests, which covered a range of velocity up to 10 fps, indicated that when pressure was kept sufficiently high to prevent vaporization or gas release, flow was quiet over the entire velocity range. This conclusion was used in establishing a reference datum with which noises produced by fittings could be compared. Noise generated at valves and fittings far exceeds that for straight pipe runs.

Contractions of flow apparently take place quietly, while sudden expansions or enlargements of the flow stream, and also sharp directional changes, produce noise. In general, more rapid pressure drops are accompanied by increased tendency to generate noise. Obviously the shape of the bounding walls of the flow stream, the pressure, temperature, velocity and probably gas content of the water are significant variables.

The next phase of the problem is the quantitative determination of the noise and vibration producing characteristics of components of piping and heating systems. It is this phase of the problem which is now receiving attention. The task is a sizeable one, because of the large number of variables involved.

When a sufficient background of quantitative data has been established against which quieting procedures can be judged, then the evaluation of the quieting effectiveness of various schemes will be undertaken. The frequencies and frequency ranges of noises and vibrations produced will be significant factors in considering means of silencing.

Possible Quieting Schemes

A few of the schemes which seem to offer possibilities will be surveyed briefly. None of these schemes has been evaluated quantitatively as yet in the course of the current investigation, although some of them have received considerable quantitative attention by other people. Although the basic ideas and principles are not new, in general, there is a need for further study of the application and relative effectiveness of the various ideas as related specifically to the problems and the variables encountered by the heating industry.

The remedies must be considered under two general categories: (1) the reduction of the intensity of noises and vibration actually created (the noise sources), and (2) the reduction in the ease of transmission of the noises and vibration to other localities where they could become more troublesome than at the point of origin.

The creation of noises is influenced by the design of the components through which flow occurs (valves, pumps, other fittings), and the manner of operation of the system. As an example of the latter item, if a system is producing noise because of cavitation, it is possible that raising the pressure of the system could reduce or eliminate cavitation and thereby reduce noise. This probably cannot be considered as a general cure-all because cavitation can be extremely localized and is influenced greatly by the local configuration of the particular fitting or component. Also, the allowable system pressure is limited.

Pressure Drops:

As another example, indications are that large, sudden pressure drops tend to produce much more noise than more gradual pressure reductions, and this seems reasonable in

view of the high localized velocities and accompanying low pressures which could be produced. The conditions are more favorable to cavitation. It can be deduced that a given total pressure drop should produce less noise if graduated over a series of valves instead of being taken across a single valve. Again, however, the design of the individual valves will influence the situation.

Noise Transmission:

Once noises have been produced, there remains the problem of minimizing their transmission. The vibrations which constitute sound are readily transmitted along both the liquid stream and the pipe-wall structure, and can travel long distances with little attenuation. Further, the pressure fluctuations (sounds) which may originate in the liquid very quickly cause vibration of the pipe-wall itself, and so both methods of transmission are of importance. There is apparently rather close coupling between liquid vibration and pipe-wall vibration. This might be expected, because both liquid water and steel are relatively incompressible.

Liquid-Borne Vibrations:

The liquid-borne vibrations can be effectively reduced by allowing the liquid to travel through soft rubber hose as has previously been briefly mentioned. The effect is to relieve the pressure peaks as the hose expands, and to dissipate energy by internal damping in the rubber as the hose repeatedly contracts and expands. The method is more effective for high-frequency vibrations than for those of low frequency because more cycles of the higher frequencies will act against the rubber walls in a given length of hose.

Soft-rubber hose has obvious limitations when consideration is given to the pressures and temperatures which must sometimes be encountered, and to the requirements of long-life, trouble-free service. Further, increasing the total liquid pressure results in greater initial distention of the rubber tube, and decreased effectiveness as a sound attenuator. Hose which consists of an inner core of rubber, plus layers of cord or fabric of some sort (such as steam hose) can accommodate reasonable pressures and temperatures for reasonable periods of time, but such hose is noticeably inferior to plain tubing in attenuating sound.

Rubber itself is practically incompressible, and in order to function as a sound attenuator, it must have space into which it can expand as it receives pressure fluctuations. The *give* of the cords around the rubber tube of steam hose is relatively slight, and not much room is available *between* cords, obviously. For comparable effects, the length of steam (reinforced) hose required must be many times that of plain tubing.

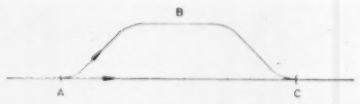

Fig. 7—Possible pipe arrangement for producing interference effects

Means other than rubber tubing might be used to solve some of the problems. For example, a flow chamber might be packed with small hollow gas-filled spheres with sufficiently elastic walls to allow pressure relief, or with a sponge-rubber type of material with an internal structure of permanently gas-filled cells. The cross-section must be adequate to permit flow without excessive pressure-drop. For high-frequency noises, such a chamber could be relatively small, but for low frequencies it might be prohibitively large. It would be desirable to have water-to-rubber contact for many cycles (and wave lengths) for effective damping.

It is conceivable that the viscosity of the water itself might be useful if properly utilized. Consider water flow through a porous material in which the water passageways are of capillary size. A chamber packed with some substance such as steel wool is an example. Oscillations of the water would tend to be damped out by the large viscous drag along the bounding surface areas.

Damping by Piping Arrangements:

Another possibility for reduction of transmitted noise is offered by suitable piping arrangements which might introduce interference effects. Fig. 7 shows a possible arrangement. A simplified explanation follows. If the length of the branch pipe *B* is such that the part of the sound wave at *A* which traverses the pipe *B* arrives at *C* out of phase with the wave portion which goes straight through to *C*, then a cancellation or interference effect might be expected. Actual sounds encountered will rarely be of single frequency, but such an arrangement might be made to possess somewhat broad-band characteristics. Another related idea is that of the dynamic absorber, in which a system could conceivably be tuned so that a pressure pulse could be absorbed by an elastic member, and the energy delivered back to fill in the rarefaction portion of the cycle. These schemes remain to be tried.

Isolating Pipe from Structure:

To reduce structural-borne vibration, there are the possibilities of isolating the piping from noise (vibration) sources by suitable couplings, and of introducing damping. As a coupling, a suitable length of soft rubber hose can be effective, but there are obvious disadvantages which have been previously mentioned. More rigid couplings which are suitable for higher pressures and temperatures would be expected to be less effective, as they also are in attenuating fluid-borne sound. Damping can be introduced by special pipe supports, pipe wrappings or other devices which allow sliding as vibration occurs. The sliding friction removes energy from the vibration, thereby reducing the amount transmitted.

Another rather obvious item which should be mentioned here is the use of solid pipe supports which effectively transmit pipe-wall vibration to floors and walls of buildings, and

sometimes allow large panels to act as sounding boards. Breaking the solid connections by using flexible supports to decouple pipe vibration from the building structure obviously can sometimes be helpful.

This brief survey indicates at least some of the methods and general principles which are pertinent to the problems of this investigation. The various possibilities remain to be quantitatively evaluated for the conditions of interest in the present study. As has been mentioned, the investigation up to the present time has been concerned with the establishment of an experimental setup in which the desired variables could be controlled, and with suitable instrumentation so that quantitative measurements could be made. Future reports will present quantitative information which is determined during the continuing course of the investigation.

Acknowledgment

The author wishes to acknowledge especially the active interest, support and cooperation of Prof. B. H. Jennings, chairman of the Department of Mechanical Engineering of Northwestern University Technological Institute, during the inception and continuation of this project.

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DR. GREENBURG AND W. L. FLEISHER ACTIVE IN AIR POLLUTION CONTROL

Dr. Leonard Greenburg, Commissioner of Air Pollution Control, New York, N. Y., announced on May 28, that he would start a *vigorous new assault on the city's air contamination problem, notably smoke.*

W. L. Fleisher, Sr., Life Member and a past president of the Society, was appointed chairman of the Air Pollution Control Department's new technical advisory committee.

Responding to Dr. Greenburg's appeal for increased personnel and facilities to broaden New York's attack on air contaminants, the New York Board of Estimate provided $85,064 for yearly salaries of new engineers, inspectors and chemists and set aside an additional $26,700 for non-payroll costs including equipment for a new laboratory.

The new staff engineers will examine plans for installation of new heating equipment and check on installations. The engineers will also make a study of all existing heating equipment and fuels, Dr. Greenburg said, with the objective of bringing all sources of trouble under control. The laboratory, he explained, *should enable us to speak with authority about what we have in the air*, and also should help determine how much air pollution comes from New Jersey and how much is home-grown.

ASHVE COOPERATIVE EXHIBIT AT ANNUAL MEETING OF AMA DRAWS MANY SPECTATORS

The 102nd Annual Meeting of the *American Medical Association* held June 1-5, 1953 in New York City featured 400 outstanding reports by leaders in all branches of medicine. The numerous sessions were conducted at seven different hotels, while the 635 scientific and technical exhibits were displayed on four floors of Grand Central Palace. Among the 271 scientific exhibits which drew many spectators was a demonstration of *Physiological Adjustment of Clothed Persons to Sudden Changes in Environment.*

The research for this exhibit was conducted by the College of Medicine and Department of Mechanical Engineering at the University of Illinois in cooperation with the Society and the United States Public Health Service. The ASHVE members who participated in the research are associated with the University and include R. W. Keeton, M.D., F. K. Hick, M.D., M. K. Fahnestock, Nathaniel Glickman, and Tohru Inouye. Lionel Bernstein, M.D., University of Illinois, also contributed to the study.

The exhibit consisted of two air-conditioned spaces, one kept at a comfortable temperature and humidity and the other kept at hot uncomfortable conditions. A model dressed in summer clothing was moved from one space to the other. Temperatures from several points on the skin and rectum were automatically recorded. Abnormalities of body temperature regulation were studied and the temperature adjustments were included for hyperthyroids and hypothyroids and normal and obese subjects. Postural hypotension after exposure to heat as well as dangers of heat retention fevers in the sick were shown. An engineer also demonstrated the devices used in measuring temperature, humidity and air motion, including radiometer, anemometer and globe thermometer.

Summary of Chapter Meetings*

• *ARKANSAS:* The May meeting was presided over by Pres. Herman Cumnock at the Sam Peck Hotel. He introduced the guest speaker, W. W. Hull, Alco Valve Co., St. Louis, Mo., who presented a talk and film on *Refrigeration Controls.*

J. L. Brown made a motion that the present membership be divided into two teams which would challenge each other to obtain the most members. The drive is scheduled to run through the November meeting. Attendance 30. Attendance ratio 0.47.

• *BALTIMORE:* E. Pugh, assistant manager of the Maryland Underwriters Bureau, presented an interesting talk on *Fire Prevention in Air Conditioning Systems.* He stressed the fact that most regulations evolved from previous fire losses and that regulations reduce fire hazards. Mr. Pugh also discussed the history and functions of the *National Board of Fire Underwriters, National Fire Protection Association, Underwriters Laboratory* and the *Rating Bureau.*

An auditing committee was appointed with J. K. Wolford as chairman. The other members comprising the committee are N. L. Spinelli and E. J. Morris.

Pres. E. R. Kent called the April meeting to order at the Engineers Club. E. S. Berngartt introduced the speaker. Attendance 74. Attendance ratio 0.58.

• *BRITISH COLUMBIA:* The May meeting was called to order by Pres. M. E. Minaker at the Quadra Club. The following members were elected as officers for the new season: *President*—C. W. Leek; *Vice President*—S. C. Gale; *Secretary*—D. A. English; *Treasurer*—Cornelius Van Boeyen; *Board of Governors*—S. W. Welsh and R. D. Hale.

D. W. Thomson suggested that Retiring President Minaker be presented with a past president's pin. J. L. Maw, chairman of the entertainment committee, presented a color film entitled *Packaged Power* which showed the various phases of aluminum production. Attendance 35. Attendance ratio 0.70.

• *CENTRAL NEW YORK:* This was a joint meeting of the Central New York Chapter and the Western New York Chapter held in Rochester, N. Y. The feature of the evening was a symposium entitled *Heating, Ventilating and Air Conditioning in Industrial Buildings.* The moderator was R. E. Cherne, consulting engineer, Rochester, N. Y. The speakers were as follows: P. D. Robson, president of Robson & Woese, Inc., Syracuse, N. Y., who discussed the problems of heating; H. A. Mosher, mechanical engineer, Eastman Kodak Co., Rochester, N. Y., whose topic was ventilation of large buildings; I. S. Molinet, et al. Attendance 43.

• *CENTRAL OHIO:* The speaker of the evening at the May meeting was H. E. Degler, technical director, The Marley Co., Kansas City, Mo., who spoke on *Water-Cooling Equipment for Refrigeration and Air Conditioning.* Mr. Degler pointed out that the use of water in American cities has gone from 100 gal of water per person per day in 1940 to approximately 200 gal per person per day at the present time.

Pres. A. D. Bogen presented a Life Membership Certificate to A. W. Williams, and then presented past presidents' plaques to R. B. Breneman, R. S. Curl, H. G. Hays and W. M. Myler, Jr. Retiring President Bogen turned the gavel over to Pres. N. T. Hess, who in turn presented Mr. Bogen with a past president's plaque. The meeting was called to order by President Bogen following dinner in the Fort Hayes Hotel. Attendance 79. Attendance ratio 0.68.

• *CENTRAL OHIO:* Following dinner, Pres. A. D. Bogen called the April meeting to order and the minutes of the last meeting were read and approved and the treasurer's report was submitted. Following an interesting and informative discussion on the New State of Ohio Building Code, the nominating committee presented its slate of nominees for 1953-54, which was unanimously elected as follows: *President*—N. T. Hess; *Vice President*—J. A. Guy; *Secretary*—R. A. Wilson, and *Treasurer*—W. A. Schoonover.

The speaker of the evening was B. W. Cornelius, partner and mechanical engineer, Sims, Cornelius & Schooley, Columbus, who spoke on the *History and New Developments of Heating Systems.* Attendance 30. Attendance ratio 0.26.

• *CINCINNATI:* The May meeting was called to order in the Clovernook Country Club and was presided over by Pres. H. E. Russell.

The following officers were elected for the year: *President*—R. C. Beineke; *Vice President*—F. W. Wilson; *Secretary*—A. H. Gerdsen; *Treasurer*—R. G. Anderson; *Board of Governors*—T. D. Reiley.

Newly elected President Beineke accepted the gavel of office and told of his plans for the season. Attendance 85. Attendance ratio 0.54.

• *CINCINNATI:* The March meeting was called to order by Pres. H. H. Russell after which various committees presented their reports.

Treas. A. H. Gerdsen reported a cash balance of $143.83. A. W. Edwards commented on a special letter to be sent to all local chapters

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

urging them to expend their efforts to increase their membership. A motion was passed that the three immediate past presidents be appointed as the nominating committee with the exception of J. J. Bechtol, who is a member of the Board of Governors, and, therefore, is not eligible to serve as a member of this committee.

R. H. Endeiann was the moderator of the panel discussion which terminated the evening. Attendance 42. Attendance ratio 0.37.

Mr. Hoagland announced that the next meeting would be held at the Three Cups Inn and the speaker would be R. D. Tutt, chief engineer with Tuttle & Bailey, New Britain.

• *CONNECTICUT:* Pres. G. F. Nieske called the May meeting to order at Three Cups Inn, and the minutes of the previous meeting were read and approved. C. L. L' Hommedieu presented a financial report and President Nieske announced that the Golf Outing would be held June 16 at the Waterbury Country Club.

The appointment of the following committee chairmen was announced: R. W. Briggs—*membership;* R. B. Sweet—*meetings;* C. L. L'Hommedieu—*finance;* H. J. Blakeley—*enforcement and legislative;* D. M. Hummel and Winfield Roeder—*Connecticut Technical Council.* It was also announced that T. L. Arnold and G. F. Nieske had been appointed member and alternate member on the Chapters Conference Committee.

The speaker of the evening was R. D. Tutt, chief engineer, Tuttle & Bailey Co., New Britain, Conn., who spoke on *Modern Trends in Air Distribution.* Attendance 58.

• *EMPIRE STATE CAPITAL:* At the May meeting the following officers were unanimously elected: *President*—N. W. Burrill; *First Vice President*—G. G. Davis; *Second Vice President*—E. C. Doyle; and *Secretary-Treasurer*—L. V. Appleby.

Newly elected President Burrill introduced the guest speaker, Mr. Stafford, General Electric Co., who spoke on *Power by which We Live.* Mr. Stafford discussed the steam turbine and presented a film on it. A lively question and answer period followed the talk.

Retiring Pres. Harry Horowitz was presented with a past president's pin by G. G. Davis. Attendance 22. Attendance ratio 0.55.

• *GOLDEN GATE:* The May meeting featured talks by A. H. Agathon, supervising engineer of the Boiler Section of the California State Division of Industrial Safety, and L. N. Hunter, first vice president of the

L. N. Hunter
Johnstown, Pa.

Society and vice president of research, The National Radiator Co., Johnstown, Pa. Mr. Agathon's talk covered portions of the requirements of the State of California as they apply to boilers.

Mr. Hunter spoke on the subject of *Rating Heating Boilers,* in which he covered the requirements of *I-B-R, Steel Boiler Institute, Heating, Piping & Air Conditioning Contractors National Association* and *American Gas Association,* and outlined the similarities and differences in these several rating procedures. A question and answer period followed each talk.

Pres. T. J. White called the meeting to order, and reports were made by the chairmen of the membership, reception, finance and legislative committees. Attendance 73.

• *ILLINOIS:* The April meeting included an inspection trip to the *Museum of Science and Industry* in Chicago. Following dinner in the museum Pres. M. W. Bishop called the meeting to order after which he made several announcements. He also read a letter from the *American Power Conference* in which appreciation was expressed for the Chapter's participation at their meeting. The evening terminated with a series of lectures on the various exhibits at the museum. Attendance 80. Attendance ratio 0.27.

• *INDIANA:* The April meeting consisted of an afternoon inspection tour of both Terre Haute Brewing Co. and Rose Polytechnic Institute followed by a business evening session.

Guest speaker H. A. Moench, professor and head of the Department of Electrical Engineering, Rose Polytechnic Institute, Terre Haute, Ind., gave a most interesting talk on the history and aims of the Institute. The meeting was presided over by Pres. J. T. Hardin at the Terre Haute House. Attendance 35.

• *INLAND EMPIRE:* The May meeting was presided over by Pres. T. P. Nau at the Spokane Hotel. After several reports from committee chairmen were read, Mr. Nau presented Retiring Pres. L. E. Marque with a past president's pin.

The following officers were unanimously elected for the 1953-54 term: *President*—G. M. Dieter; *Vice President*—H. A. Bickel; *Secretary*—F. W. Jenkinson; *Treasurer*—Max Tonn; *Board of Governors*—T. P. Nau, G. C. Murray and R. D. Nevers.

The meeting was then turned over to new President Dieter who was presented with the Chapter Charter. He discussed the 1953 Annual Meeting in Chicago and also outlined a program of membership expansion. Attendance 22.

• *MANITOBA:* A highlight of the April meeting was the appearance of ASHVE First Vice Pres. L. N Hunter who gave a stimulating talk on *Boiler Codes* which was well illustrated by slides. An interesting question and answer period followed.

The meeting was presided over by Pres. W. J. Atkinson who called for

a minute of silence in memory of the late R. W. Rogers. A nominating committee, selected from the Board of Governors, was asked to report at the May meeting. Attendance 41. Attendance ratio 0.44.

• *MASSACHUSETTS:* The April meeting featured the annual *Student Night* and D. W. Blair, the originator of this event, presided. It was held at the Faculty Club of M.I.T.

The four speakers of the evening were as follows: L. E. Seeley, past president of the Society and dean of the College of Technology at the University of New Hampshire, Durham, N. H.—*Opportunities in Teaching and Research;* William Morgan, Cambridge Corp.—*Manufacturing Opportunities;* L. M. Munroe, Beaulieu & Munroe Co., Boston, Mass.—*Opportunities as Manufacturers' Representatives;* and R. K. del'Etoile, Delbrook Ventilating Co.—*Opportunities in the Contracting Field.*

New members elected to the Chapter include: L. E. Peloquin, D. W. Priestly, William Rubinstein and R. P. Sullivan. Pres. G. B. Torrens called the meeting to order. Attendance 100.

• *MEMPHIS:* The May meeting was called to order by Pres. A. W. Shelby at the King Cotton Hotel. After a report from the picnic committee, he presented past presidents' pins to W. L. Drake, 1952-53; R. E. Larkin, 1951-52; and C. S. Fischer, 1950-51.

Guest speaker C. Q. Livingston, industrial insulation division, Armstrong Cork Corp., Lancaster, Pa., chose as his subject, *A New Look at Thermal Insulation.* He mentioned the need for re-evaluation of thermal insulation and used slides to illustrate his talk. An interesting question and answer period followed. Attendance 29.

• *MEMPHIS:* M. H. Ellis, Jr. introduced the speaker of the evening, R. L. Sherrill, Jr., Westinghouse Electric Corp., Boston, Mass., who spoke on his experiences in the field of packaged type heat pumps. He also discussed the results of trial installations in different parts of the country.

The following officers were elected for 1953-54: *President*—A. W. Shelby; *Vice President*—H. H. Wilson; *Secretary*—A. T. Bevil; and *Treasurer*—L. V. Eberle, Jr.

The gavel was turned over to newly elected President Shelby who appointed a picnic committee consisting of W. L. Drake, W. E. Thorpe and E. G. Woodson.

• *MIAMI VALLEY:* The Chapter was honored at its March meeting to have as its guest, ASHVE First Vice Pres. L. N. Hunter, vice president, Research, The National Radiator Co., Johnstown, Pa., who was introduced by J. M. Schweiger. Mr. Hunter's subject was *The Rating of Heating Boilers.* He gave a very interesting discussion on the history, purposes and results of the different boiler rating codes which are now being used.

The following committee chairmen were heard from: J. B. Rishel—*membership;* R. W. Kimmel—*finance;* C. T. Doudican—*legislative;* D. C. Le Coumpte—*nominating;* J. H. Pierce—*entertainment.*

The March meeting was presided over by Pres. D. L. Bergman, who discussed the board of governors meeting held prior to the regular meeting. Attendance 32. Attendance ratio 0.39.

• *MIAMI VALLEY:* At the April meeting, the following members were elected to serve for 1953-54: *President*—J. M. Schweiger; *Vice President*—R. W. Kimmel; *Secretary*—D. E. Tullis; *Treasurer*—J. B. Rishel; *Board of Governors*—R. J. Perkins and L. P. Brehm, Jr.

Guest speaker O. J. Ress, chief engineer, L. J. Mueller Furnace Co., Milwaukee, Wis., selected *Residential Cooling and Heating* as his subject. Mr. Ress traced the development of the warm-air furnace from the original stove to the current forced-air furnace. He stated that the warm-air industry in the past few years has been active in aligning its developments with those of the building industry. An interesting discussion followed Mr. Ress' talk. Attendance 44. Attendance ratio 0.62.

• *MICHIGAN:* The final meeting for this season was called to order by Pres. C. A. Strand at the Meadowbrook Country Club. He announced the following new officers: *President*—R. H. Oberschulte; *Vice President*—E. F. Glanz; *Secretary*—D. S. Falk; *Treasurer*—J. N. Livermore; *Board of Governors*—Axel Marin, D. L. McConachie, R. E. McIntosh; and *Ex-Officio*—C. A. Strand.

After installation of the new officers by W. H. Old, G. W. Akers presented a past president's plaque to C. A. Strand. Attendance 129.

• *MINNESOTA:* Following a talk presented by H. E. Degler, technical director, The Marley Co., Kansas City, Mo., Pres. William Sturm reported on the results of the election as follows: *President*—V. E. Pearson; *Vice President*—J. A. Craig; *Secretary*—E. T. Erickson; *Treasurer*—J. S. Locke; *Board of Governors*—J. G. Hamm and W. A. Swenberg.

President Sturm read a card from Mrs. Dorothy Gerrish in which she thanked the Chapter for its expression of sympathy upon the death of her husband, H. E. Gerrish. Mr. Sturm also stated that a memorial was sent to the Dunwoody Institute in memory of the late H. S. Crosby.

Reports were given by the various committee chairmen after which E. A. Thompson of the Rocky Mountain Chapter was introduced.

The April meeting was held at the Dyckman Hotel and presided over by President Sturm.

• *MONTREAL:* Pres. B. J. Horsburgh called the May meeting to order at the Windsor Station

Restaurant. He then called upon J. P. Fitzsimmons to present an engraved gavel and past president's pin to W. G. Hole.

William McCrudden, McGill University, Montreal, Que., Canada and E. Nadon, Ecole Polytechnique, Montreal, were announced as winners of the Chapter's *Annual University Students Awards.*

T. E. Cockman, chairman of the golf committee, reported that the Chapter Tournament would be held June 25 at the Lachute Golf Club and that an invitation had been extended to the Ottawa Chapter. The evening concluded with the presentation of four films on industrial ventilation, refrigeration, safe driving and travel. Attendance 70.

• *NEBRASKA:* The Chapter was honored by a visit from First Vice Pres. L. N. Hunter who spoke on *The Rating of Heating Boilers.* Mr. Hunter gave an illustrated address showing the origins and standards of the various systems by which heating boilers are rated in the U.S.A. This was followed by a lively discussion period.

Pres. S. W. Black called the May meeting to order at the Cornhusker Hotel after which he introduced the new members. K. E. Martin, chairman of the nominating committee, announced the slate of officers for the new season. Attendance 32. Attendance ratio 0.33.

• *NEBRASKA:* The guest speaker, G. R. Whitnah, instructor, Department of Mechanical Engineering, University of Minnesota, Minneapolis, Minn., selected as his topic *Air Distribution In Small Duct Systems.* Mr. Whitnah gave an enlightening talk on air carrying capacity and pressure loss for standard and special types of small round ducts and fittings. His presentation was illustrated by slides and followed by a lively question and answer period.

The following members were appointed as chairman to the nominating committee: Verne Simmonds, B. G. Peterson, K. E. Martin and K. R. Magarrell.

G. R. Whitnah
Minneapolis, Minn.

One minute of silence was observed by the members of the Chapter in memory of the late late D. E. McCulley.

The April meeting was called to order at the Castle Hotel by Pres. S. W. Black. Attendance 34. Attendance ratio 0.34.

• *NEW YORK:* The May meeting was called to order by Pres. P. B. Gordon at the Building Trades Club. He then presented a Society Life Membership Certificate to W. E. Heibel and announced that certificates would also be sent to A. E. Bastedo and M. F. Rather. President Gordon introduced the officers for the new term as follows: *President*—J. E. Schechter, *Vice President*—R. L. Stinard; *Treasurer*—W. M. Heebner; *Secretary*—Carl H. Flink; *Board of Governors*—H. S. Birkett, Albert Giannini, J. B. Hewett, Clifford Strock and P. B. Gordon.

Past Pres. H. S. Johnson presented a plaque from the Chapter to President Gordon as a token of appreciation for the excellent service that he had rendered the Society.

J. M. Levy, partner, Levy & O'Keefe, New York, N.Y., spoke on *Schoolhouse Heating and Ventilating.* Mr. Levy traced the operations involved from the time a community plans a schoolhouse until the actual contracts are awarded. An interesting discussion period followed. Attendance 125. Attendance ratio 0.22.

• *NEW YORK:* The April Annual Meeting was called to order at the Building Trades Club by Pres. P. B. Gordon, who introduced two new members, Milton Dormont and D. K. Roberts.

After several committee chairmen presented their reports, the following officers were elected for the new term: *President*—J. E. Schechter; *Vice President*—R. L. Stinard; *Treasurer*—W. M. Heebner; *Secretary*—C. H. Flink; *Board of Governors*: P. B. Gordon, H. S. Birkett, Albert Giannini, J. B. Hewett and Clifford Strock.

President Gordon introduced the speaker for the evening, A. L. Jaros, Jr., consulting engineer and partner, Jaros, Baum & Bolles, New York, N.Y., who spoke on *Panel Cooling.* Mr. Baum stated that panel cooling is not a method to replace air conditioning systems. It is just another tool for the use of the air conditioning engineer. The panels can absorb about 50 percent of the sensible heat load, thus reducing the size of the air conditioning systems required. He also stressed the fact that air conditioning is particularly useful in absorbing the heat from lights which have high temperature elements and radiate a large part of their heat to a panel, although the panel is at the temperature of the air in the room. Attendance 130. Attendance ratio 0.23.

• *NORTH JERSEY:* The May meeting, which was the final business meeting of the season, was presided over by Pres. F. H. Faust. It was announced that the next meeting would be held in October. The board of governors, however, will meet in the interim to transact whatever business may be necessary and to organize programs for the next year.

Program chairman H. M. Patrick reported on the plans for the June social meeting. It was confirmed that the Essex Country Club had been engaged for sports during the day, and dinner and entertainment in the evening.

The speaker of the evening, H. N. Crowell, Therm-O-wheel, Inc., New York, N.Y., described a device designed to recover the heat of exhaust air in ventilating systems and to save the "cold" in the air being exhausted in air conditioning systems. Attendance 70.

• *NORTH JERSEY:* Guest speaker B. A. Jacobi, chief engineer, Lerner Stores Corp., New York, N.Y., discussed the problems encountered in heating and ventilating different size stores. A lively question and answer period followed.

Pres. F. H. Faust presided over the April meeting after which H. M. Patrick, program chairman, made several announcements. Attendance 78.

• *NORTH TEXAS:* The speaker at the May meeting was Marvin Nichols, Fort Worth consulting engineer and nominee for chief of the Bureau of Reclamation, who was introduced by J. G. Blum. Mr. Nichols presented an excellent talk on the need for future water conservation by the Dallas and Fort Worth areas. He stated that even though recent rains had temporarily alleviated the water shortage, the moving of industrial plants into the area requires a long distance planning program for conservation.

Pres. P. N. Vinther called the meeting to order, after which the minutes of the previous meeting were read and approved. President Vinther thanked the planning committee for this meeting for doing an excellent job. The committee consisted of C. L. Zahn, T. B. Romine, Jr., J. L. Tye and J. G. Blum. Attendance 106. Attendance ratio 0.41.

• *NORTHERN OHIO:* W. F. D. Neiheiser introduced the guest speaker, I. E. Brooke, consulting engineer, Chicago, Ill., who spoke on *Experiences (Confessions) of a Consulting Engineer.* Mr. Brooke gave a lively description of his experiences with the first steam turbine power station located in Chicago. He also discussed some of the problems encountered in a constant-current street lighting system and in an underground fire hydrant system.

Secy. J. R. Venning read some announcements which dealt with the following: *Technical Conference on Residential Air Conditioning* held at Lehigh University, Bethlehem, Pa., the *Conference on Basic Odor Research Correlation*, New York, N.Y., and an invitation from the Rocky Mountain Chapter to attend the Semi-Annual Meeting in Denver.

The April meeting was called to order by Pres. R. E. Sherman at the Allerton Hotel. Attendance 56.

• *ONTARIO:* New officers for the 1953-54 season were elected at the Chapter's May meeting, held in the Royal York Hotel, as follows: *President*—N. W. Kingsland; *Vice President*—M. C. Bailey; *Secretary-Treasurer*—H. R. Roth; *Board of Governors*—D. L. Angus, C. J. Bootes and Charles Torry; *Ex-Officio*—J. H. Ross. Retiring President Ross turned the gavel over to President Kingsland who in turn, presented Mr. Ross with a past president's certificate and a diamond studded Society emblem, commending him for a splendid year.

The speaker of the evening, H. M. Gully, director of public relations, Silverwoods Dairies, Ltd., was then introduced. Mr. Gully spoke on *Hay Fever as a Hobby.*

The business meeting which preceded election of officers was called to order by President Ross and featured the presentation of reports by all the committee chairmen. Announcements were also made relative to the Chapter's Spring Golf Meet held on June 4 at Lakeview Golf & Country Club and the Society's Semi-Annual Meeting in Denver. Attendance 87.

• *OTTAWA VALLEY:* D. W. Banton introduced the guest speaker, H. A. Lockhart, chief engineer, Bell & Gossett Co., Morton Grove, Ill., whose topic was *Hot Water Heating.* Mr. Lockhart outlined the fundamentals of hot water heating and its advantages over other heating systems by the use of illustrations. He stated that hot water systems, when kept full of water and seldom drained, could last for 100 years. An interesting question and answer period followed his discussion.

Harold A. Lockhart
Morton Grove, Ill.

A. H. Hargreaves and S. J. Bullis were elected to the auditing committee. The April meeting was called to order at the Prescott Hotel by Pres. Bernard Stotesbury. Attendance 44.

• *PACIFIC NORTHWEST:* Following a social hour and dinner, the secretary read a digest of the executive committee's discussion, at a special luncheon, on the Chapter's position in connection with the formulation of new codes by the City of Seattle. It was decided that the Chapter should not be involved in partisan disputes but should be willing to render assistance to a legislative group on a sound technical basis. A motion was made and carried that a standing committee be appointed by the president to respond to any request from the City Council for impartial technical advice regarding proposed or existing codes.

Mr. Britten, city boiler inspector, gave a brief talk on the city's problems in connection with codes, outlining the procedures being followed in the development of a new city boiler code. He expressed appreciation for any future assistance the Chapter and its members might render in this connection. Attendance 50. Attendance ratio 0.35.

• *PHILADELPHIA:* At the April meeting, the following officers were unanimously elected: *President*—C. F. Dietz; *First Vice President*—L. M. Church; *Second Vice President*—A. M. Robertson; *Treasurer*—C. J. Lubking; *Secretary*—P. H. Yeomans. C. J. Forve was also elected as a member of the Board of Governors.

Guest speaker G. W. Meek, construction engineer, New York, N.Y., gave a very interesting talk on *Of*

What Interest Is Odor to Air Conditioning Engineers? This was followed by a lively question and answer period.

The meeting was presided over by Pres. M. E. Barnard at the Engineers Club. Attendance 30. Attendance ratio 0.28.

• *PITTSBURGH:* Pres. B. B. Reilly called the meeting to order following dinner, and the minutes of the April meeting were read and approved. President Reilly then thanked the chairmen of the various committees for their faithful service and cooperation during the year. C. L. Benn presented the treasurer's report and W. W. Johnson of the auditing committee presented his report, confirming that the Chapter's finances were in order. J. W. Frazier was appointed alternate to represent the Pittsburgh Chapter on the Chapters Conference Committee.

The following were then elected officers for the 1953-54 season: *President*—C. H. Schneider; *Vice President*—E. C. Hach; *Secretary*—E. H. Riesmeyer, Jr., *Treasurer*—C. L. Benn; and *Board of Governors*—H. B. Grabman and O. L. Williams. Retiring President Reilly turned the gavel over to President Schneider, who presented Mr. Reilly with a past president's pin.

The remainder of the evening was devoted to entertainment and social activities. Attendance 55.

• *SACRAMENTO VALLEY:* The May meeting consisted of a regular business session on the sixth followed by a field trip to Folsom Dam Site on the ninth. The highlight of the business meeting was a visit by ASHVE First Vice Pres. L. N. Hunter, Johnstown, Pa., who discussed the Society's future activities and the problems confronted by ASHVE due to its expansion.

R. A. Sarro introduced Samuel Burks, assistant project engineer in charge of Folsom Dam concrete operations, who gave an excellent talk on the history of dam cooling. E. C. McKinsey then outlined the design problems at the refrigeration plant.

D. R. Blanchard introduced the new members as follows: E. A. Leskey, W. D. Kunz and R. R. Reece. The meeting was called to order by Pres. L. A. O'Meara. Attendance 62. Attendance ratio 0.57.

E. C. McKinsey conducted ASHVE members through the refrigeration plant at Folsom Dam Site on May 9. The plant has a capacity to cool 5,400 yards of concrete per day at a temperature of 47 F. To accomplish this, more than 1000 tons of ammonia refrigeration equipment was installed. The flake ice system of 235 tons daily is believed to be the largest of its type in the western United States. Atttendance 35. Attendance ratio 0.46.

• *SACRAMENTO VALLEY:* Pres. L. A. O'Meara called the April meeting to order at the Coral Reef. D. R. Blanchard introduced the new members as follows: F. L. *Vern* Brown, H. F. Boothby and C. J. Nicholas.

A. J. Routhier read a few interesting passages from a 19th Century textbook on heating. Then Program chairman E. C. McKinsey introduced the guest speaker, A. J. Hess, president of Hess-Greiner & Polland, Los Angeles, Calif., who spoke on *High Temperature Hot Water Heating.* Mr. Hess reviewed the history of hot water heating and described proper design procedures. He also stressed the importance of proper pump selection and location, choice of temperature controls, and pipe sizing and location of air vents in the design of high pressure hot water systems.

A. J. Hess
Los Angeles, Calif.

A nominating committee was selected and included: F. E. Hawley, W. B. Lander, H. B. Lewis, H. D. Brainard and S. W. Doolittle. Attendance 55. Attendance ratio 0.52.

• *ST. LOUIS:* Pres. C. H. Burnap called the May meeting to order at Town Hall. He announced the following officers for the new term: *President*—H. C. Sharp; *First Vice President*—G. H. Bemarkt; *Second Vice President*—J. F. Naylor, Jr.; *Secretary*—W. P. Norris; and *Treasurer*—F. E. Ince.

Mr. Sharp, newly elected president presented a past president's pin to Retiring President Burnap as a token of appreciation from the Chapter. He then introduced the guest speaker, E. A. Freund, Union Electric Co., whose subject was *Heat Pumps To Date.* Mr. Freund stated that the heat pump is becoming increasingly practical. He concluded that installation cost is being steadily reduced as more is learned of proper application. His talk was very well illustrated with slides. Attendance 39.

• *ST. LOUIS:* The April meeting was called to order by Pres. C. H. Burnap at the Killebrew Engineering Co. Host J. B. Killebrew introduced Bernard Kosteck who spoke on *Why and How Heat Exchangers Are Built.* Mr. Kosteck showed three different plastic models of heaters and described methods of cleaning and maintaining them. Then Charles Schroeter discussed *Codes Covering the Manufacture of Heat Exchangers.* Mr. Schroeter cited the danger of not using equipment covered or built to code regulations.

G. B. Pattiz reported on the pledges made by various members as blood donors. He also read the names of members on the honor roll who had fulfilled their pledges. Attendance 135.

• *SHREVEPORT:* M. A. Hudson introduced the speaker, D. E. Berry, district sales manager, Carrier Corp., New Orleans, La., who selected as his topic, *The Application of Small Room Air Conditioning Units.*

JOURNAL SECTION

The following members were elected for the new year: *President*—M. A. Hudson; *Vice President*—J. S. Malahy; *Secretary*—R. S. Segall; *Treasurer*—H. E. Scott; *Board of Governors*—A. G. Dixon and J. L. Collins, Jr.

O. J. Dykes, Jr. was named chairman of the *Committee on Arrangements* for the picnic held on June 13. The other members comprising the committee included W. S. Evans, M. A. Hudson, and J. S. Malahy. Attendance 29. Attendance ratio 0.53.

• *SHREVEPORT:* The April meeting was called to order by Pres. W. S. Evans. Minutes of the previous meeting were read and approved. This was followed by reports from the various committee chairmen.

N. E. Berry, director of research, Servel Inc., Evansville, Ind., was introduced as the guest speaker. Mr. Berry selected as his subject absorption refrigeration systems and their application. A question and answer period terminated the discussion. Attendance 50. Attendance ratio 0.60.

• *SOUTH TEXAS:* Society Pres. Reg. F. Taylor reported on his visit to the Pacific Northwest where he attended the 8th Oregon State Air Conditioning Conference held at Portland, Ore. He stated that the Council recently issued a Charter to a new Chapter to be known as the Mississippi Chapter at Jackson, Miss.

B. P. Fisher, presenting a report on research and public relations activities, spoke about research in cooperation with the University of Texas Medical School, Galveston, Tex., where studies have been conducted in air drying and the treatment of burns and the measurement and effect of bacteria.

O. G. Rivoire introduced the principal speaker of the evening, Norman Harker of Fort Worth, Tex., who presented two films. The first was a sales film explaining the closing of a sale, while the second dealt with the operation of thermostatic expansion valves.

Reg. F. Taylor
Houston, Tex.

The April meeting, held at the Alabama Catering, was presided over by Pres. C. L. Fleming. Attendance 75. Attendance ratio 0.31.

• *SOUTHERN PIEDMONT:* The April meeting was called to order by Pres. R. E. Mason at the Selwyn Hotel. J. A. Rice gave a report on the plans for the summer meeting at Roaring Gap. F. L. Lawrence, Jr. named two new members and stated that the membership committee had several good prospects ready to sign.

J. G. Hopping, Jr. introduced J. K. Hawks, Evans Engineering Co., Birmingham, Ala., who presented a most interesting speech on *Chemical Dehumidification.* Attendance 35.

• *SOUTHWEST TEXAS:* The May meeting was called to order by Pres. D. E. Locher at the Manor Tea Room. He introduced the guest speaker, W. E. Long, professor of mechanical engineering, University of Texas, Austin, who discussed the *Acme Housing Project* in Austin. Professor Long stated that this project was developed as the result of FHA's insistence that wall construction have a *U* factor which would meet their requirements. Five masonry houses and one frame house were constructed. He added that tests were made on these houses on a 24-hour basis in both winter and summer which indicated that the massive wall was superior to that of the frame house. Attendance 24. Attendance ratio 0.28.

Attention!!
Members of ASHVE
Moved or Moving?

Each month mail is returned BECAUSE you overlooked advising us of the change in your address.

The return mail is a loss to you, and an added expense to the Society.

In your own interest, will you please advise us at once of any change in your business or home address, indicating which is your mailing address.

ASHVE Headquarters
62 Worth St.
New York 13, N. Y.

• *UTAH:* At the May meeting, which was called to order by Pres. D. R. Wilde, the following officers were elected for the coming season: *President*—M. L. Gollaher; *Vice President*—Alfred Richeda; and *Secretary-Treasurer*—G. L. Soderborg, Sr.

E. L. Baker presented a report on the activities of the Chapter. Then the secretary gave a financial report for the year. J. L. Ashton suggested that the method of assessing dues be changed. Attendance 14. Attendance ratio 0.53.

• *UTAH:* E. L. Baker introduced the guest speaker, Dr. L. S. Saunders, who presented a most enlightening talk on *The Effect of Air Conditioning on Human Health.* Dr. Saunders stated that the nose and throat constitute a human air conditioning system which filters, heats and humidifies the air we breathe. Improper air conditioning can prevent the nose and throat from performing their functions properly, opening the way for various types of infections and disorders. For summer air conditioning, Dr. Saunders recommended that indoor temperature be not more than 10 to 15 deg below outdoor temperature.

Vice Pres. M. L. Gollaher presided over the April meeting which was held at the Newhouse Hotel.

• *WASHINGTON, D. C.:* N. M. Love introduced the guest speaker, William Bachelar, assistant chief engineer, Tuttle & Bailey, New Brit-

ain, Conn., who spoke on the relative merits of low, medium and high pressure systems. Mr. Bachelar also discussed perimeter heating systems. An interesting question and answer period followed.

Officers elected to serve for the new term are as follows: *President*—J. G. Muirheid; *Vice President*—G. C. F. Asker; *Treasurer*—J. W. Alexander; *Secretary*—W. C. Reamy, Jr.; *Board of Governors*—G. R. Walz, J. J. Nolan, Jr. and J. C. Benson. J. G. Muirheid was elected a member and P. R. Achenbach, alternate member on the Chapters Conference Committee.

The April meeting was called to order by Pres. G. R. Walz. Attendance 62.

• *WESTERN NEW YORK:* The feature of the May meeting was a talk by C. W. Farrar, vice president and general manager of sales, Richmond Radiator Co., New York, N.Y. Joseph Davis introduced Mr. Farrar as having been one of the outstanding members of the Chapter. Mr. Farrar recalled the founding of the Chapter and the men who helped in its organization on January 18, 1919, as the Society's ninth Chapter. He then paralleled the growth of the Society with that of the heating, ventilating, and air conditioning industry, stating that the heating industry involves some $2,860,000,000 a year and that the up-and-coming field of air conditioning is expected to top that with an immediate potential of 4 billion dollars per year.

The results of the election of officers were announced as follows: *President*—C. W. Stone; *First Vice President*—R. E. Lang; *Second Vice President*—Q. P. Thompson; *Secretary*—C. W. Kaupp; *Treasurer*—M. C. Beman; *Board of Governors*—J. M. Quackenbush, M. C. Beman, Joseph Davis, Roswell Farnham and D. J. Mahoney. S. M. Quackenbush then presented a past president's certificate to Retiring Pres. J. M. Quackenbush, and it was noted that this was probably the first time in Chapter history that a past president had presented his son with a past president's certificate.

During the business meeting, the treasurer's report was submitted and approved subject to auditing by Messrs. Kaupp and Beman, and the minutes of the Chapter's April 15

C. W. Farrar
New York, N.Y.

joint meeting with the Central New York chapter were read and approved with one slight correction. At the conclusion of the meeting a rising vote of thanks was extended to Mr. Farrar for his very interesting talk and the special trip he made to be at the meeting. Attendance 70.

• *WISCONSIN:* J. R. Akerman introduced the guest speaker, P. A. Argentieri, development engineer, Connor Engineering Corp., Danbury, Conn., who spoke on *Odors and Flavor Transference: Their Nature, Cause and Control.* Mr. Argentieri stated that odors are divided into four categories: fragrant or sweet, acid or sour, burned, caprylic or goaty. They are further divided by a numerical system from one to eight, with eight being listed as the strongest. For example, a rose has a numerical value of 6423, which means that it is a fragrant, medium sour smell, has a slight burned odor and somewhat goaty. Mr. Argentieri also stressed the fact that, after prolonged contact, the human olfactory nerves become fatigued and fail to respond to certain odors.

Membership chairman J. E. Illingworth announced the new members as follows: F. H. Jenkins, F. C. Hackett, F. T. Jena, N. P. Runge and J. E. Peterson.

Pres. J. A. Lofte called the April meeting to order at the Nakoma Country Club. Attendance 59. Attendance ratio 0.26.

Student Branch

• *OKLAHOMA A. & M. COLLEGE:* The May meeting was called to order by Pres. E. M. Todd, Jr., in the Engineering Building. Reports were presented on the two exhibits displayed by the Society at the Engineering Exposition held in April. The first exhibit was a model house which featured different heating systems. The second exhibit was a refrigerated cold chair which included pipe through which brine was circulated to obtain the refrigeration effect. As a back drop to the cold chair was a drawing of a devil and a furnace. The inscription above the exhibit read *The Engineers Prepare for the Hereafter.* In front of the exhibit was an order book for those who were not sure and would like to order their chair early.

Since there was not a majority to hold elections, President Todd appointed R. P. Schmidt as acting president until next fall when the new semester opens. Attendance 5. Attendance ratio 0.32.

• *OKLAHOMA A. & M. COLLEGE:* Pres. E. M. Todd, Jr. introduced the guest speaker, A. C. Shelly, engineering draftsman, Loeffler-Greene Supply Co., Oklahoma City, Okla., whose topic was perimeter and baseboard heating. A lively question and answer period followed. Mr. Shelly was accompanied by J. E. Montin who is in charge of ASHVE student relations. Attendance 6. Attendance ratio 0.50.

"Engineer's Plan for the Hereafter" Exhibit of the Oklahoma A & M Student Branch at college engineering exposition

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 160 applications for membership, including 4 student applications and 4 reinstatements; in addition 13 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by July 31, 1953, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement

Arizona

BAYLESS, LYNN, Supt., Valley Sheet Metal Co., Phoenix. REFERENCES: R. L. Bayless, Jr., W. A. Biddle, John Boylson, V. J. Carns.

BIDDLE, W. A., Sales Engr., Boyd Engineering Co., Inc., Phoenix. REFERENCES: A. C. Baechlin, R. L. Bayless, Jr., V. J. Carns, F. W. Gabbard.

BOEHME, R. A., Engr., Frank Harmonson Co., Phoenix. REFERENCES: John Armer*, A. C. Baechlin, W. A. Biddle, V. J. Carns.

BOOTHROYD, E. P., Engr., Climate Control Co., Phoenix. REFERENCES: A. C. Baechlin, W. A. Biddle, V. J. Carns, M. M. Lowry.

†BROWNING, D. M., Supvsr., City of Phoenix, Phoenix. REFERENCES: R. L. Bayless, Jr., W. A. Biddle, John Boylson, V. J. Carns.

BYRON, L. A., JR., Mech. Engr., Lester Byron, Architect, Phoenix. REFERENCES: A. C. Baechlin, W. A. Biddle, V. J. Carns, G. W. Hummel.

CASSELL, W. W., Supt., Cassell & Covington, Tucson. REFERENCES: G. W. Hummel, Benjamin McLain, N. A. Pennington, P. M. Tidmarsh.

CROW, G. D., Co-Owner, Catalina Sheet Metal Works, Tucson. REFERENCES: J. S. Blackmore*, J. C. Hornung, Ralph Kerns*, R. N. Oliver*.

FOX, A. J., JR., Draftsman, Johnson Bros., Phoenix. REFERENCES: G. W. Hummel, M. M. Lowry, A. L. Pistor, J. P. Sorensen.

FUTRELLE, J. H., Dist. Repr., The Coleman Co., Inc., Phoenix. REFERENCES: R. L. Bayless, Jr., L. C. Carney*, V. J. Carns, W. E. Otis*.

GOETTL, A. D., Co-Owner, International Metal Products Co., Phoenix. REFERENCES: R. L. Bayless, Jr., Howard Clifford*, Harry Keffer*, C. C. Sawyer.

GOETTL, GUST, Co-Owner, International Metal Products Co., Phoenix. REFERENCES: A. B. Burton*, Glen Jones*, O. C. Palmer, C. C. Sawyer.

HAGGARD, B. K., Construction Supt., Johnson Bros., Phoenix. REFERENCES: Harry Angerman, A. C. Baechlin, J. R. Bell, Jr., F. W. Gabbard.

HAYFORD, R. H., Dist. Repr., Minneapolis-Honeywell Regulator Co., Phoenix. REFERENCES: W. J. Biggar, V. J. Carns, J. B. Hoaglund, C. T. Snider.

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△Timpe, C. L., Engr., Richard M. Stern, Mech. Engr., Seattle. References: D. O. Mead, R. M. Stern, C. I. Vinsonhalor, N. W. Wilson.

Valentine, W. M., Mech. Engr., George W. Stoddard & Assocs., Seattle. References: E. T. Franklin, Jr., D. C. Griffin, K. H. Norby, R. M. Stern.

Wisconsin

Anderson, C. V., Chief Engr., Boiler Div., Cleaver-Brooks Co., Eau Clair. References: V. P. Hansen, A. S. Krenz, L. C. Plaehn, R. J. Tutsch.

†Barlow, F. J., Secy.-Treas., Azco Inc., Appleton. References: F. J. Jenkins, Harry Koller*, J. A. Lofte, Joe Maldari*.

Canada

Bach, H. L., Owner-Mgr., Atlas Service Co., Toronto. References: W. H. Evans, J. H. Fox, N. W. Kingsland, H. R. Roth.

Burns, G. M., Mech. Engr., M. M. Dillon & Co., London, Ont. References: T. K. Birss*, F. W. Partridge*, D. O. Price, A. C. Simpkins.

Cooper, G. G., Prof. Engr., Shepherd & Powell, Cons. Engrs., Toronto, Ont. References: A. D. Duncan*, William MacLean*, R. W. Powell*, David Shepherd*.

Coutts, D. R., Sales Engr., John Inglis Co., Ltd., Toronto, Ont. References: E. A. Aberdeen, W. C. Atkinson*, W. A. Connor, K. B. Martin.

Little, W. K., Estimator, E. S. Fox Plbg. & Htg., Ltd., Welland, Ont. References: C. J. Bootes, D. O. Price, J. H. Ross, G. E. Smith.

Mitchell, R. M., Sales Mgr., C. A. Dunham Co., Ltd., Toronto, Ont. References: J. Attwood*, M. C. Bailey, M. S. Barker, W. H. Harper*.

Ritchie, R. A., Secy., John Ritchie Ltd., Toronto, Ont. References: W. R. Blackhall, W. M. Flanagan, F. D. Ledgett, A. G. Ritchie.

Skinner, H. R., Asst. Chief Engr., Waterman-Waterbury Mfg. Co., Ltd., Regina, Sask. References: Geoffrey Angus, D. D. Daniels, G. R. Forrester*, J. A. Wedgewood*.

Denmark

Westenholz, S. T., Managing Dir., Nordisk Ventilator Co., Nestved. References: J. Jacobsen*, N. Lichtenberg*, Jorgen Varming, George Werner.

England

△Benham, C. S. K., Dir., Benham & Sons Ltd., London. References: Oscar Faber*, G. N. Haden, J. R. Kell, L. C. Watts.

India

△Malik, M. A., Cons. Engr., Trichinopoly. References: S. K. Bhattacharya, J. H. Carpenter, R. S. Dill, Henry Henfield.

Japan

Yanagimachi, Masanosuke, Pres., Takasago Netsugaku Kogyo KK., Tokyo. References: K. L. Crapeau*, Yoshizo Kondoh*, E. A. Mishler*, E. C. Worden, Jr.*

STUDENTS

UNIVERSITY OF DETROIT, Detroit, Mich. Certified by: J. E. Lay.

Cairns, J. R. — Rumpf, J. C.
Novak, N. L. — Zimmerman, W. E.

Cyril Tasker

Director of ASHVE Research

Dies Suddenly

1899-1953

Cyril Tasker

MEMBERS OF the ASHVE were greatly shocked to learn that Cyril Tasker, Director of Research for the Society, died suddenly on May 27. His age was 54. Mr. Tasker had attended a meeting of the I=B=R held at the Seaview Country Club, Absecon, N. J. and was en route home when he succumbed to a heart attack in Warren, Ohio.

He had been director since 1943 and previously for 13 years was a member of the staff of the Ontario Research Foundation. As a senior research fellow at the foundation, he carried on important investigations relating to fuels, and a variety of problems connected with heating and air conditioning.

Mr. Tasker was born in Manchester, England, and was graduated from the University of Manchester in 1923 with the degree of M. Sc. (Tech). Until 1930, when he came to Canada, he was on the staff of the British Fuel Research Board. He became a member of the Society in 1935 and had served as a member of the Committee on Research, and of the following Technical Advisory Committees from 1936 to 1943; Fuels, Insulation, Physiological Reactions, Air Conditioning in the Industry, and Sensations of Comfort. He was elected to Council in 1941 and resigned upon receiving the appointment as research director.

He had also been active in the Ontario Chapter, served on its Board of Governors, and was president for the 1941-42 season. Mr. Tasker held memberships in *The Institution of Heating and Ventilating Engineers*, the *Institute of Fuels*, *The American Society of Metals*, and had been a frequent contributor to technical publications in the United States, Canada, and England. His reports to the Society on the work at the Cleveland Laboratory are well known in the profession.

The sudden death of Cyril Tasker cuts short a career that held promise of many more contributions in the field. Shortly after his appointment as director of research the Laboratory was moved from the U. S. Bureau of Mines in Pittsburgh, Pa., to its own building, then located at 10700 Euclid Ave., Cleveland, Ohio. In 1946 the Society purchased the present laboratory at 7218 Euclid Ave., and Mr. Tasker supervised the setting up of the facilities in this new location.

Mr. Tasker directed ASHVE research relating to air distribution, solar heat gain and heat transmission through glass, heat flow in concrete and plaster panels, the design and development of a human calorimeter for the U. S. Navy, and panel heating studies in the new Environment Laboratory.

His many friends on Council, the Committee on Research, and the Technical Advisory Committees with whom he worked closely, and the Society members who met him at meetings will greatly miss his presence.

Surviving is his widow, Mrs. Ada Ruth Tasker, to whom the Officers and Council of the Society extend their sincere sympathies.

In tribute to his fine work, all of the officers and numerous members of the Society attended the funeral services which were held on June 1, 1953 at Cleveland, Ohio.

SHERMAN F. COGHLAN
Los Angeles, Calif.

Society member Sherman F. Coghlan, president of J. M. Montgomery & Co., Inc., Los Angeles, passed away on April 25, 1953. Mr. Coghlan joined the Society in 1937.

Mr. Coghlan was born in Patchogue, N.Y., on October 1, 1894. He attended Valparaiso and Syracuse Universities, graduating in 1917 with a B.S. From 1917 to 1919 Mr. Coghlan was associated with the American Brake Shoe and Foundry Co., Erie, Pa., as a designer. Mr. Coghlan joined the Southern California Edison Co. as a mechanical engineer in 1919 remaining with that firm until 1931. At this time he

went with the Metropolitan Water District Co. also as a mechanical engineer where he remained for 10 years. Mr. Coghlan joined J. M. Montgomery & Co., Inc., in 1941 and was made president in 1946 in which capacity he was serving at the time of his death.

Mr. Coghlan was also a member of the *American Society of Mechanical Engineers.*

HENRY S. CROSBY
Minneapolis, Minn.

Word has just been received by the Society of the untimely passing of Henry S. Crosby, member of the Society since 1946, in a plane crash at Trumansburg, N.Y., on March 19. Mr. Crosby, vice president of the plant engineering control for General Mills, Inc., and his assistant, LeRoy R. Jamison, had taken off from Buffalo enroute to New York in Mr. Crosby's single-engine, four-seat Navion.

Born on May 29, 1904 at Minneapolis, Minn., Mr. Crosby attended Phillips Academy, Andover, Mass., Yale College, graduating with a B.A. in 1926, and Massachusetts Institute of Technology, graduating with a B.S. in 1929.

Mr. Crosby joined General Mills in 1929 and worked with maintenance crews rebuilding the mill on the west bank of the Mississippi river. He moved to the drafting room and then to power and maintenance operations, becoming assistant engineer and chief engineer.

During World War II, Mr. Crosby was with the Army Air Force Materiel Command. Following his service he returned to General Mills as director of the new plant engineering department and became a vice president in 1947. It had been announced earlier that Mr. Crosby was to have resigned from the company April 1 to become an independent engineering consultant.

He was chairman of the Dunwoody Institute board of trustees, a member of Minneapolis Club, Plymouth Congregational Church, and Woodhill Country Club.

He is survived by his wife, Margaret, a son and two daughters, to whom the Society extends its deep sympathy.

JAMES J. DANNEHY
Chicago, Ill.

The Society has been advised of the passing on May 2 of one of its members, James J. Dannehy. Mr. Dannehy joined the Society in 1946 as an associate member.

Born on October 20, 1890 in Chicago, Ill., Mr. Dannehy attended Lewis Institute and Siebel Institute, both in Chicago, where he took heating, ventilating and refrigerating courses. Mr. Dannehy's first position was as superintendent in full charge of construction with the Peerless Ice Machinery Co., where he remained from 1922-29. Between 1930-31 he was associated with the A. E. Stratmeyer Co., as an estimator specializing in industrial heating and refrigeration. During the years of 1931-42, he was owner of the Midland Engineering Co. of Chicago, a heating, ventilating and air conditioning contracting firm, and secretary of C. J. Kristan Co. in charge of design and layout on heating and ventilating equipment. At the time of his death, he was an engineer with the Refrigeration Maintenance Corp. in the supervision of the installation of equipment.

He was also a member of the *American Society of Refrigerating Engineers* and was a registered professional engineer in the state of Illinois.

Mr. Dannehy is survived by his widow to whom the Officers and Council of the Society extend their deep sympathy.

WILLIAM R. TELLER
Cleveland, Ohio

Members of the heating and engineering profession were greatly saddened to learn of the death of William H. Teller on May 2, 1953.

Born in Bowling Green, Ohio on June 14, 1904, Mr. Teller attended the Case School of Applied Science, Cleveland, Ohio, graduating with a B.S. degree in mechanical engineering. After spending three years gaining field experience in gas and oil production in western Kentucky, he joined the *American Gas Association* in 1930. Shortly after Pearl Harbor, Mr. Teller was placed in charge of the newly organized war products department of the *American Gas Association* testing laboratories where he remained until he joined the Bryant Heater Corp. At the time of his death, he was director gas research and testing field and its of research and engineering for this corporation, and well-known in the allied industries.

Surviving are his widow, Mrs. Marie Maxted Teller; a daughter, Mrs. Patricia Ann Moore; a son, Bruce Maxted Teller, and one grandchild, to whom the Officers and Council of the ASHVE extend their profound sympathies.

CHARLES D. WALDON
Toronto, Ont., Canada

Charles D. Waldon, manager of the Spencer Heater Co., and member of the Society since 1932, died on May 12, 1953 in Toronto Western Hospital, of a heart attack. Mr. Waldon was made a Life Member of the Society in 1948.

Born on July 11, 1877, in Palmerston, Mr. Waldon was educated there and before going to Toronto travelled extensively in Western Canada. During his long career, Mr. Waldon was associated with many different manufacturing firms of furnaces, combination heaters, hot water boilers, etc. In 1905 he established his own firm,The Waldon Co., Winnipeg, Canadian distributors for Spencer Heater Co., International Heater Co., Garden City Fan Co., etc. In 1915 he re-organized Waldon Co. taking over the name of Spencer Heater Co. Mr. Waldon was district salesman, vice president and general manager in charge of engineering layouts, construction and operation.

Mr. Waldon was a member of the Winnipeg Lodge of Perfection, Scottish Rite. He is survived by his wife, two daughters, two sons and a granddaughter, to whom the Officers and Council of the Society extend their sympathy.

JOURNAL SECTION

HOMER ADDAMS CELEBRATES EIGHTIETH BIRTHDAY

On June 22 Homer Addams, Germantown, Philadelphia, Pa., celebrated his eightieth birthday and on the same day he and Mrs. Addams observed their 55th wedding anniversary. Dr. Addams thus attains another milestone in his lifelong career in the heating field, and now qualifies as an octogenarian.

Dr. Addams is the only Charter Member of the Society and a past president of ASHVE. In 1952, he was awarded the F. Paul Anderson Medal for outstanding work in the field of heating, ventilating and air conditioning. His name has become synonymous with ASHVE as he has served in numerous capacities. He served 7 years as Society Treasurer. He was active in the founding of the Society's Research Laboratory at the United States Bureau of Mines in Pittsburgh in 1919, and was a member of the first Guide Committee in 1922. Currently he is Chairman of the Board of Directors of the Fitzgibbons Boiler Co., Inc., New York, N.Y.

The Officers, Council and members of the Society take great pleasure in extending Birthday Greetings to Dr. Addams and best wishes for many more years of happiness to both Dr. and Mrs. Addams. His rich full life is an inspiration to all. The Society and those dear to him have greatly benefitted from his wisdom and counsel.

64TH ANNUAL CONVENTION OF *HPACCNA* IS LARGEST

The 64th Annual Convention of the *Heating, Piping and Air Conditioning-Contractors National Association*, May 13-16, held at the Edgewater Beach Hotel in Chicago, had an attendance of 862, the largest in the Association's history. The featured speaker at this record-breaking convention was Secretary of Labor Martin P. Durkin.

ASHVE Vice Pres. L. N. Hunter expressed the Society's greetings at the convention. J. S. Kearney was general chairman of the Chicago Association Convention Committee which handled the arrangements. Among the important reports presented was one given by P. B. Gordon, Society Council member, on the Radiant Panel Heating Committee.

An important event at the convention was the election of officers for the 1953-54 term. They are as follows: *President* — R. W. Lawinger; *Vice President* — J. D. Morrow; *Treasurer* — H. W. Goldner; *Secretary* — J. C. Fitts; and *Assistant Secretary* — L. B. Gruman, Jr.

MARIO C. GIANNINI MEMORIAL FUND

The establishment of a *Mario C. Giannini Memorial Fund* in honor of the late assistant dean of New York University's College of Engineering was announced on May 29 by Dean Thorndike Saville.

The principal of the fund was contributed by Professor Giannini's friends and colleagues in the University and in the New York Chapter of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, of which he served as president in 1947-48. The income from the fund will be used to provide an annual award to a mechanical engineering graduate of the Evening Division of the College of Engineering who, in his undergraduate career, has demonstrated *outstanding promise of usefulness in his profession.*

Professor Giannini, an alumnus of the College of Engineering, was a member of the College's teaching staff for 25 years and was assistant dean in charge of the College's Day Division from 1949 until he retired for reasons of health in July, 1952. He died on August 24, 1952, upon his arrival at Winter Park, Fla., where he intended to take up residence and where his family lives.

Professor Giannini also had a distinguished career as a consulting engineer in the field of heating, ventilating, and air conditioning. He was active in THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, the *American Society of Mechanical Engineers*, and the *American Society for Engineering Education*, and was elected to two honorary engineering fraternities, Tau Beta Pi and Pi Tau Sigma.

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*Member of Committee on Research.

ASHVE — OFFICERS OF CHAPTERS AND BRANCHES

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

● **ARKANSAS:** 1952. Hdqrs., Little Rock, Ark. Meets, Third Tuesday. PRESIDENT, Herman Cumnock, 401 W. Capitol Ave. SECRETARY, W. J. Franklin, 619 Rector Bldg.

● **ATLANTA:** 1937. Hdqrs., Atlanta, Ga. Meets, Second Monday. PRESIDENT, J. G. Croley, 400 Batavia St., East Point, Ga. SECRETARY, T. A. Barrow, 157 Simpson St., N.W.

● **BALTIMORE:** 1949. Hdqrs., Baltimore, Md. Meets, Third Wednesday. PRESIDENT, E. R. Kent, 2322 N. Charles St. (18). SECRETARY, A. M. Kroft, 401 Tower Building (2).

● **BRITISH COLUMBIA:** 1952. Hdqrs., Vancouver, B.C., Canada. PRESIDENT, C. W. Leek, 1155 West 49th Ave. SECRETARY, D. A. English, 6412 Adera St.

● **CENTRAL NEW YORK:** 1944. Hdqrs., Syracuse, N. Y. Meets, Fourth Wednesday. PRESIDENT, C. R. Acheson, 306 W. Genesee St. SECRETARY, H. K. Ormsby, 205 S. Townsend St. (2).

● **CENTRAL OHIO:** 1944. Hdqrs., Columbus, Ohio. Meets, Third Monday. PRESIDENT, N. T. Hess, 63 E. Goodale St. SECRETARY, R. A. Wilson, 20 S. Third St., (15).

● **CINCINNATI:** 1932. Hdqrs., Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, R. C. Beineke, 626 Broadway, (2). SECRETARY, A. H. Gerdsen, 224 E. Second St., (2).

● **CONNECTICUT:** 1940. Hdqrs., New Haven, Conn. Meets, Third Thursday. PRESIDENT, G. F. Nieske, 165 Maple St., Naugatuck. SECRETARY, E. J. Hoagland, 257 S. Whitney St., Hartford.

● **DELTA:** 1939. Hdqrs., New Orleans, La. Meets, Third Tuesday. PRESIDENT, H. L. Salaun, 317 Baronne St. SECRETARY, T. J. Jenny, 1000 S. Peters St., (9).

● **EMPIRE STATE CAPITAL:** 1951. Hdqrs., Albany, N. Y. PRESIDENT, N. W. Burrill, 33 Riverside Ave., Rensselaer. SECRETARY, L. V. Appleby, R.D. 2, Watervliet.

● **GOLDEN GATE:** 1937. Hdqrs., San Francisco, Calif. Meets, First Thursday. PRESIDENT, J. E. Murray, 350 Mission St. (5). SECRETARY, D. E. McLeod, 3740 Clay St. (18).

● **ILLINOIS:** 1906. Hdqrs., Chicago, Ill. Meets, Second Monday. PRESIDENT, H. G. Chapin, 185 N. Wabash Ave., (1). SECRETARY, H. G. Gragg, 4065 Grand Ave., Western Springs.

● **INDIANA:** 1943. Hdqrs., Indianapolis, Ind. Meets, Fourth Tuesday. PRESIDENT, R. C. Blackman, 5505 N. Illinois St., (8). SECRETARY, J. W. Jackson, 3514 N. Drexel, (18).

● **INLAND EMPIRE:** 1950. Hdqrs., Spokane, Wash. Meets, First Friday after First Tuesday. PRESIDENT, G. M. Dieter, 917 W. Mallon. SECRETARY, F. W. Jenkinson, N. 1904 Smith St., (15).

● **IOWA:** 1940. Hdqrs., Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, R. H. Schnell, 4119 Northwest Dr. (10). SECRETARY, Bowen Campbell, 1435 Casady Dr. (5).

● **KANSAS:** 1951. Hdqrs., Wichita, Kan. Meets, Tuesday after First Monday. PRESIDENT, O. P. Bullock, 254 Laura (7). SECRETARY, H. D. Speyer, 120 Ida.

● **KANSAS CITY:** 1917. Hdqrs., Kansas City, Mo. Meets, First Monday. PRESIDENT, G. H. Stotler, 200 Riss Building (6). SECRETARY, A. S. Hurt, Jr., 2119 Washington St., (8).

● **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, Third Thursday. PRESIDENT, A. K. Piercy, 222 Osborne St. N. SECRETARY, D. B. Brace, 1550 Dublin Ave.

● **MASSACHUSETTS:** 1912. Hdqrs., Boston, Mass. Meets, Third Tuesday. PRESIDENT, G. B. Torrens, 15 Alden Lane, Shrewsbury. SECRETARY, G. D. Fife, Rm. 606, 79 Milk St. (9).

● **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, Third Monday. PRESIDENT, W. L. Drake, 15 N. Reese. SECRETARY, A. T. Bevil, 1638 Union Ave. (4).

● **MIAMI VALLEY:** 1950. Hdqrs., Dayton, Ohio. Meets, First Wednesday. PRESIDENT, John Schweiger, 593 Acorn Drive, Dayton (9). SECRETARY, D. E. Tullis, 743 Kiser St. (4).

● **MICHIGAN:** 1916. Hdqrs., Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, R. H. Oberschulte, 316 McKerchey Building. (1). SECRETARY, D. S. Falk, 4864 Woodward Ave. (1).

● **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, First Monday. PRESIDENT, E. T. Erickson, 500 Baker Arcade. SECRETARY, V. E. Pearson, 739 Marquette Ave. (2).

● **MISSISSIPPI:** 1953. Hdqrs., Jackson, Miss. PRESIDENT, Burt Lomax, Jr., P. O. Box 1662. SECRETARY, J. G. Coleman, 2840 Arbor Hills Drive.

● **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, Third Monday. PRESIDENT, B. J. Horsburgh, 940 Ogilvy Ave. (15). SECRETARY, R. J. Ker, 1000 Beaver Hall Hill, P. O. Box 340.

● **NEBRASKA:** 1940. Hdqrs., Omaha, Neb. Meets, Second Tuesday. PRESIDENT, S. W. Black, 18th & Harney Sts. SECRETARY, H. H. Ulrich, 608 City Hall (2).

● **NEW YORK:** 1911. Hdqrs., New York, N. Y. Meets, Third Monday. PRESIDENT, J. E. Schechter, 28 Brower Ave., Woodmere, L. I. SECRETARY, Carl H. Flink, 62 Worth St. (13).

● **NORTH JERSEY:** 1952. Hdqrs., Newark, N. J. Meets, Second Tuesday. PRESIDENT, F. H. Faust, 5 Lawrence St., Bloomfield. SECRETARY, C. H. Smith, 2490 Vreeland Mills Rd., Linden.

● **NORTH TEXAS:** 1938. Hdqrs., Dallas, Tex. Meets, Third Monday. PRESIDENT, P. N. Vinther, 929 Mercantile Securities Bldg. SECRETARY, J. A. Ray, 4411 Belmont Ave. (4).

● **NORTHEASTERN OKLAHOMA:** 1948. Hdqrs., Tulsa, Okla. Meets, Second Tuesday. PRESIDENT, J. N. Watt, 528 E. Fifth. SECRETARY, J. C. Netherton, Jr., 3130 E. 44th St.

● **NORTHERN OHIO:** 1916. Hdqrs., Cleveland, Ohio. Meets, Second Monday. PRESIDENT, R. E. Sherman, 570 Hanna Bldg. (15). SECRETARY, R. G. Huebscher, 7218 Euclid Ave. (3).

● **NORTHERN PIEDMONT:** 1952. Hdqrs., Greensboro, N.C. PRESIDENT, J. E. Hart, 1001 E. Bessemer Ave. SECRETARY, S. T. Oliver, 2307 Fairfield Ave.

● **OKLAHOMA:** 1935. Hdqrs., Oklahoma City, Okla. Meets, Second Monday. PRESIDENT, W. J. Collins, Jr., 1708 Westminster Pl. SECRETARY, F. X. Loeffler, Jr., 1604 N. W. Fifth St.

● **ONTARIO:** 1922. Hdqrs., Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, N. W. Kingsland, 31 Willcocks St. SECRETARY, H. R. Roth, 57 Bloor St., W.

● **OREGON:** 1939. Hdqrs., Portland, Ore. Meets, Thursday after First Tuesday. PRESIDENT, A. N. Hoss, 621 S.W. Alder (5). SECRETARY, J. E. Finkbeiner, 10260 S.W. Daphne Pl. (1).

● **OTTAWA VALLEY:** 1952. Hdqrs., Ottawa, Ont., Canada. PRESIDENT, Bernard Stotesbury, 955 Somerset St. W. SECRETARY, E. J. Schoenherr, 32 Clarey Ave. (1).

● **PACIFIC NORTHWEST:** 1928. Hdqrs., Seattle, Wash. Meets, Second Tuesday. PRESIDENT, W. B. Pride, 3111 Dose Ter. (44). SECRETARY, I. L. Winsor, P.O. Box 7077, Riverton Hgts, Br. (88).

● **PHILADELPHIA:** 1916. Hdqrs., Philadelphia, Pa. Meets, Second Thursday. PRESIDENT, C. F. Dietz, 3449 W. Indiana Ave. (32). SECRETARY, P. H. Yeomans, Architects Building (3).

● **PITTSBURGH:** 1919. Hdqrs., Pittsburgh, Pa. Meets, Third Monday. PRESIDENT, B. B. Reilly, Fifth & Liberty Aves. (22). SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St. (22).

● **ROCKY MOUNTAIN:** 1944. Hdqrs., Denver, Colo. Meets, First Wednesday. PRESIDENT, L. H. Wray, 1101 Geneva St., Aurora. SECRETARY, J. F. Cipra, Jr., 2676 S. Madison St.

● **SACRAMENTO VALLEY:** 1952. Hdqrs., Sacramento, Calif. PRESIDENT, E. C. McKinsey, 4220 Annette (21). SECRETARY, R. A. Sarro, 5412 Argo Way.

● **ST. LOUIS:** 1918. Hdqrs., St. Louis, Mo. Meets, Second Tuesday. PRESIDENT, C. H. Burnap, 235 Keruish Pl., Webster Groves (19). SECRETARY, J. F. Naylor, Jr., 2335 S. Grand Ave. (4).

● **SHREVEPORT:** 1948. Hdqrs., Shreveport, La. Meets, Third Thursday. PRESIDENT, M. A. Hudson, P.O. Box 1055 (89). SECRETARY, R. S. Segall, 603 Cotton St.

● **SOUTH TEXAS:** 1938. Hdqrs., Houston, Tex. Meets, Third Friday. PRESIDENT, C. L. Fleming, 809 M. & M. Bldg. SECRETARY, J. W. Holland, 245 Esperson Bldg. (2).

● **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, First Tuesday. PRESIDENT, L. B. Davenport, 137 S. Anderson St. (33). SECRETARY, J. L. McCullough, 1978 S. Los Angeles St. (11).

● **SOUTHERN PIEDMONT:** 1952. Hdqrs., Charlotte, N.C. PRESIDENT, R. E. Mason, 1726 Hutchinson Ave. (1). SECRETARY, S. B. Blanton, Box 6096.

● **SOUTHWEST TEXAS:** 1946. Hdqrs., San Antonio, Tex. Meets, Third Tuesday. PRESIDENT, D. E. Locher, Box 949, Corpus Christi. SECRETARY, F. B. Frazee, 1013 Riverside Dr., Austin.

● **UTAH:** 1944. Hdqrs., Salt Lake City, Utah. Meets, Third Thursday. PRESIDENT, M. L. Gollaher, 1163 Roosevelt Ave. (5). SECRETARY, G. L. Soderborg, Sr., 42 E. 8th St. S.

● **VIRGINIA:** 1946. Hdqrs., Norfolk, Va. Meets, Third Wednesday. PRESIDENT, E. D. Duval, 1023 Hanover Ave. SECRETARY, T. B. Carpenter, 412 Chester St.

● **WASHINGTON, D. C.** 1935. Hdqrs., Washington, D.C. Meets, Second Wednesday. PRESIDENT, J. G. Muirheid, Bureau of Ships, Navy Dept. (25). SECRETARY, W. C. Reamy, Jr., 17th & Pennsylvania Ave., N. W. (6).

● **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, H. R. Limbacher, 760 E. Vine St., Kalamazoo. SECRETARY, F. K. Platt, P.O. Box 307, Kalamazoo.

● **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, Second Monday. PRESIDENT, C. W. Stone, 503 Franklin St. (2). SECRETARY, C. W. Kaupp, 271 Delaware Ave.

● **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, Third Monday. PRESIDENT, N. E. Hill, 122 N. Hartwell Ave., Waukesha. SECRETARY, K. H. Fortar, 2711 N. 27th St. (10).

SPECIAL BRANCH

● **SWISS:** 1952. Hdqrs., Zurich, Switzerland. PRESIDENT, Leo de Bruyn, Muhlebachstr. 172, Zurich. SECRETARY, Walter Hausler, Erbstrasse 2, Kusnacht, Zurich.

STUDENT BRANCHES

● **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRESIDENT, Sydney Narvey, 3-B Vet-ville, State College Station. SECRETARY, E. A. Travis, Jr., P.O. Box 3332, College Station.

● **OKLAHOMA A. & M. COLLEGE:** 1950. Hdqrs., Stillwater, Okla. Address mail to Prof. R. R. Irwin, Dept. of M. E., Oklahoma A. & M. College.

● **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, R. E. Bulletsel, 252 Kings Rd. SECRETARY, I. P. Parkhurst, 454 Harrison.

● **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind. CHAIRMAN, N. J. Kirch, 922 Highland Ave., Lafayette. SECRETARY, H. F. Allen, Jr., 629 University St.

● **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station, Tex. Meets, Second and Fourth Tuesday. PRESIDENT, C. E. Beavers, Box 4083. SECRETARY, C. R. Blank, Jr., Box 2021.

● **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, First Tuesday. PRESIDENT, T. J. Feahney, Jr., 18263 Oak Dr. (21). SECRETARY, W. F. Thull, 18313 New Jersey (19).

● **UNIVERSITY OF KANSAS:** 1949. Hdqrs., Lawrence, Kans. Address mail to Dr. Warren E. Snyder, chairman, Dept. of Mechanical Engineering, University of Kansas.

● **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin, Tex. Meets, First and Third Tuesday. PRESIDENT, H. M. Braymer, 1307-C Brackenridge Apts., (3). SECRETARY, A. D. Wilkinson, Jr., 1423-B Brackenridge Apts., (3).

● **UNIVERSITY OF TORONTO:** 1951. Hdqrs., Toronto, Ont. CHAIRMAN, D. S. Harper, 737 Sammon Ave. SECRETARY, L. S. Mitchell, 88 Lawrence Crescent.

WHY THE FITZGIBBONS BOILER "D" TYPE IS

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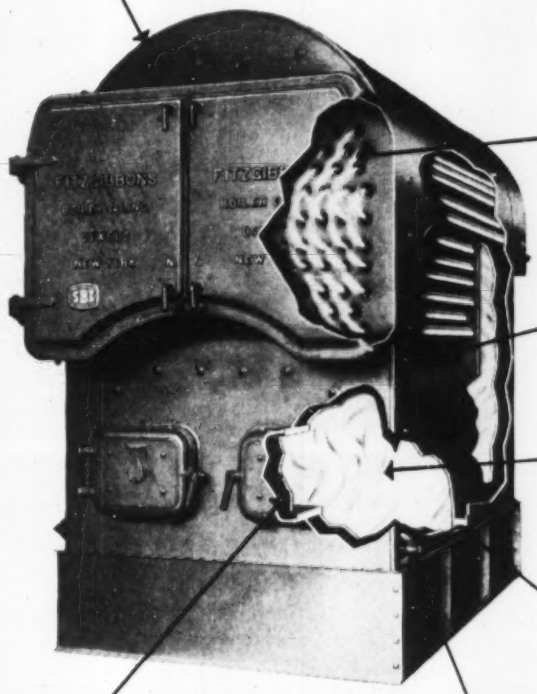

1 Steel Construction – heavy "flange" quality steel plate is electrically welded to provide strength and durability. Workability of steel permits boiler design for quick, economical transfer of heat.

2 Easy Cleaning For All Surfaces – tubes are reached through large doors at front of boiler. Firedoors give ample access to firebox heating surfaces.

3 Rapid Water Circulation – concentration of heat at high point of crown sheet and unimpeded waterways induces faster circulation, brings more water in contact with more heating surface in a given time.

4 Complete Combustion – firebox of adequate height and volume provides maximum efficient burning of fuel. Ideal for oil, gas, or coal (stoker or hand-fired).

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7 Rugged Door Frame – water-cooled fire door frame of extra-heavy steel is welded between shell and firebox water wall. An asbestos gasket-sealed, soot-tight fire door completes the assembly.

All these features add up to economy, long life, and low maintenance cost. Fitzgibbons boilers meet or exceed ASME code requirements in all construction details; are certified by a Hartford Inspector. Sixteen sizes from 876,000 Btu to 10,200,000 Btu. For complete details, write to the Fitzgibbons Boiler Company, Inc., 101 Park Avenue, New York 17, N. Y. Ask for catalog HP-7.

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EXCLUSIVE FEATURES SPELL QUALITY CONSTRUCTION

LARGE POWERFUL MOTOR. Has power to spare. Overload protected and resiliently mounted for quiet operation.

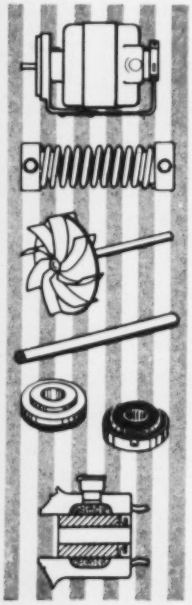
STRONG FLEXIBLE DRIVE SPRING isolates impeller from motor for quiet vibrationless operation.

CAST BALANCED IMPELLER (Not stamped). Casting the impeller in one piece makes certain of long uninterrupted service.

HARDENED GROUND STAINLESS STEEL SHAFT. Made to a plus tolerance of zero and minus tolerance of .0004. Then superfinished for long life smooth operation.

PATENTED ROTARY SEALS. Highest quality rotary seals make for trouble free operation.

POROUS BRONZE BEARING-LARGE OIL RESERVOIR. Long porous bronze bearing lubricates impeller shaft while keeping it in perfect alignment.



Contractors and big users alike are enthusiastic about the new Taco Circulators — and with good reason. This big-value line is specifically designed to meet the needs of the heating market of *today:*

Extra capacity for small pipe radiant heating jobs — radiator, convector, baseboard or panel. Just one size circulator to stock and use — with ¾″, 1″, 1¼″ and 1½″ interchangeable flanges to handle any job.

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Taco

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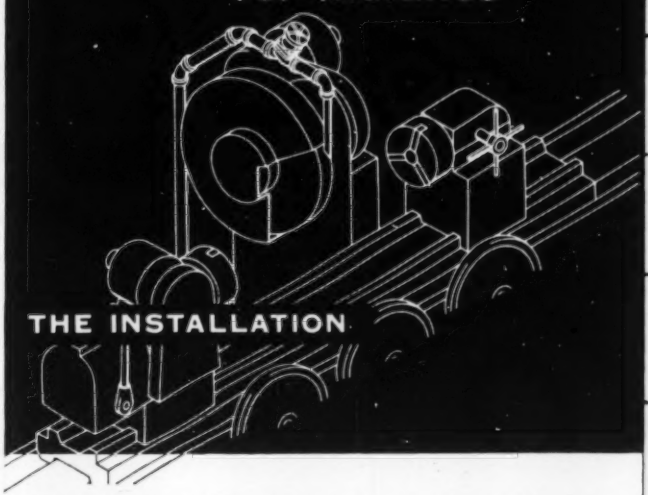
How this Valve Solved a Costly Problem ... on Abrasive Fluid, for instance



At Standard Crankshaft & Hydraulic Co., Inc., Charlotte, N. C., with Crane diaphragm valves on regrinding machines, controlling flow of grinding solution to the work.

VALVE SERVICE RATINGS

SUITABILITY:	Far better than expected
FEATURES:	Pliable neoprene disc insert
MAINTENANCE COST:	Zero
SERVICE LIFE:	Now 8 times longer than other valves
OPERATING RESULTS:	Forced machine down time stopped
AVAILABILITY:	Crane catalog item—No. 1610

THE CASE HISTORY

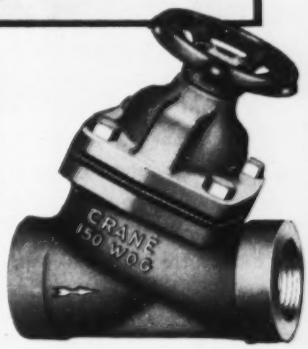
About 3 weeks was the maximum service life of the conventional globe valves formerly on these machines. Their disc and seat were quickly cut out by the abrasive and steel dust that mixed with the re-circulated lubricant. Keeping up with replacements was costly in valves as well as extended machine down time.

Crane 1610 Diaphragm Valves were selected to help if not remedy the situation. They would last longer. Their pliable Neoprene disc insert would absorb the foreign particles that cause leakage and wire-drawing in ordinary valves. And when needed, a disc could be renewed in a few minutes.

But results were far better than expected. The Crane valves installed more than 6 months ago are still in service with no repairs; show no sign of trouble. Naturally, these valves have been put on all grinders.

THE VALVE

Neoprene disc insert seating is but one feature of Crane Packless Diaphragm Valves. Their sealed bonnet isolates working parts from line fluid. Independent disc and diaphragm design reduces diaphragm wear; permits closure on fluid even should diaphragm fail. These valves come in many body and trim materials for corrosive, abrasive, or common services. See your Crane Catalog or Crane Representative.



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CAPACITOR-START MOTORS

for general purpose applications with high starting torque

Wagner capacitor-start induction motors are a sound choice for applications where starting loads are fairly heavy, but which can be brought up to operating speed quickly. They have become increasingly popular for installation on equipment such as air conditioners, refrigerators, freezers, water pumps, motor-driven tools, and on similar fractional or integral horsepower applications.

These motors offer low maintenance cost—only a minimum of servicing is required—and they give many years of reliable service with unusual freedom from vibration and noise.

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When you standardize on Wagner Motors—you get the advantages of a liberal warranty ... of nation-wide service facilities, with on-the-spot service, replacement motors and parts available from 25 Wagner-owned Service Branches and more than 750 Authorized Service Stations. You can choose from a wide variety of types and sizes—single-phase or polyphase—(from 1/125 to 400 hp). Bulletin MU-185 gives complete information—write for your copy.

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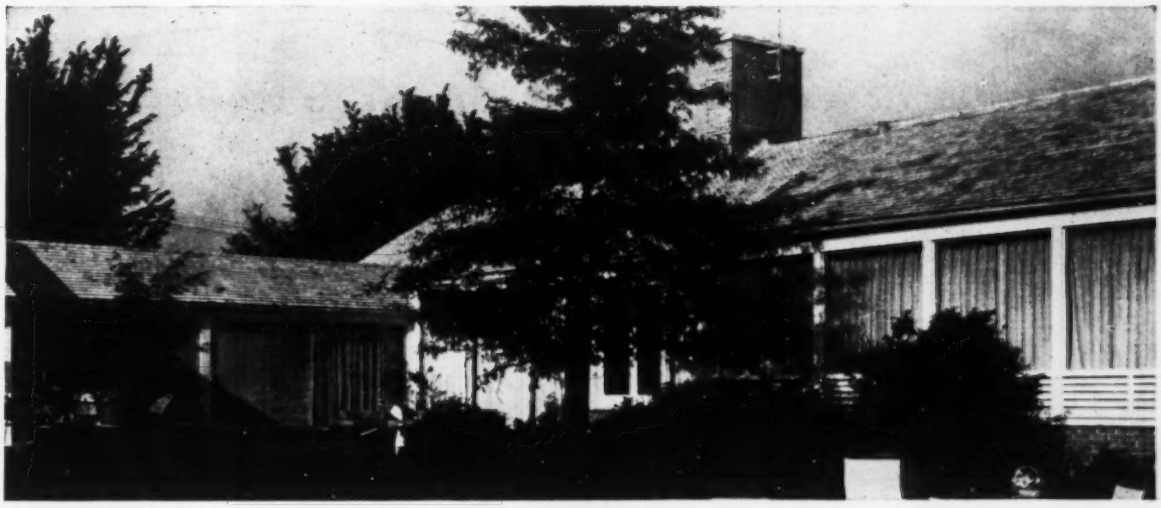
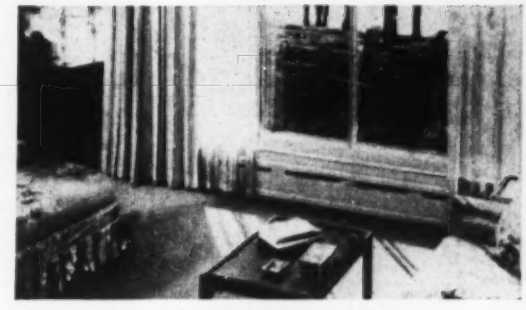
BRANCHES IN 32 PRINCIPAL CITIES

M53-15

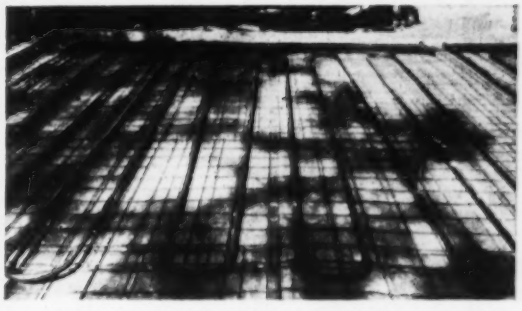


HOMES WITH MODERN WINDOWS NEED

B&G *Hydro-Flo* Heating



...WITH BASEBOARD PANELS



...WITH RADIANT FLOOR OR CEILING PANELS

B & G *Hydro-Flo* Forced Hot Water Heating correctly solves the problem of heating homes with large glass areas. When used with modern baseboard or radiant panels, a curtain of warmth is raised against incoming cold —protecting against icy down-drafts from the windows— keeping floors comfortably warm. Every inch of the home equipped with B & G *Hydro-Flo* Heating is *livable space!*

B & G *Hydro-Flo* Heating furnishes not only a better *quality* of heat, but better *controlled* heat as well... so smoothly modulated that every change in the weather is met with a corresponding change in the heat supply. No overheating fuel waste—no underheating chills!

Add to this a year 'round supply of indirectly-heated domestic hot water—ample for automatic washers, baths and showers—and you have the reason for today's trend to B & G *Hydro-Flo* Heating.

Send for descriptive literature.

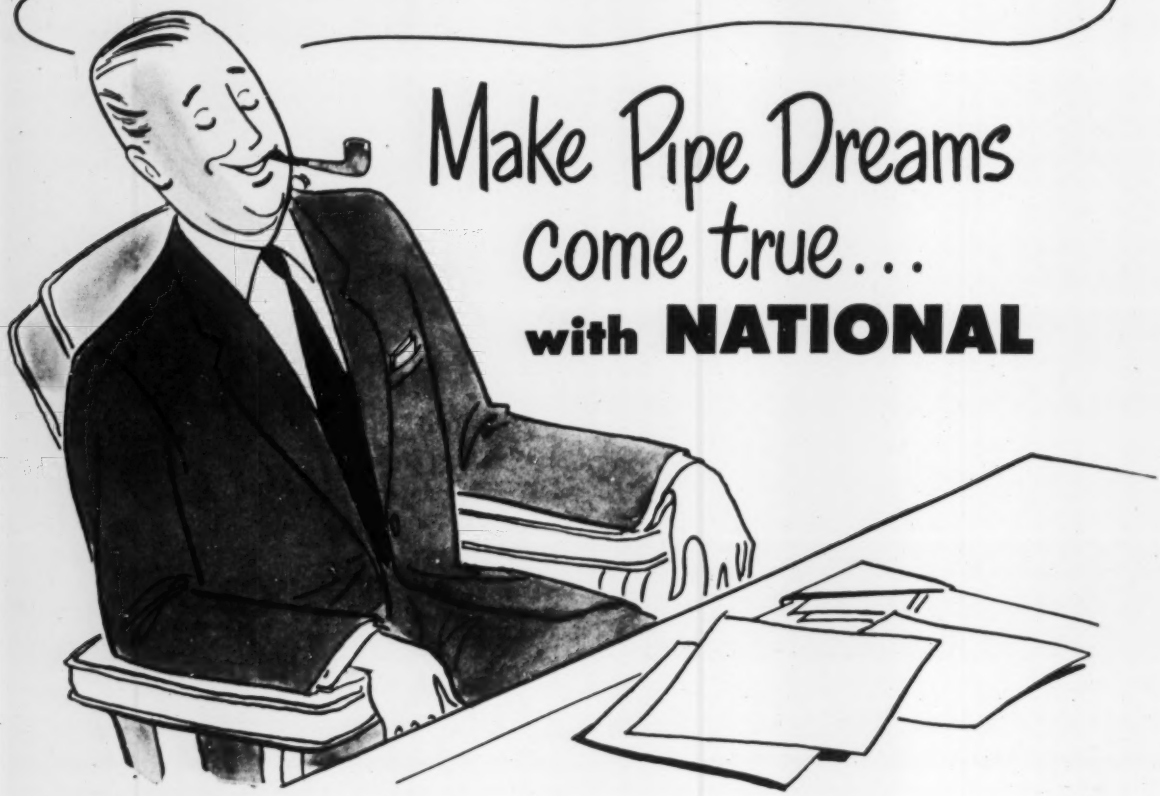
BELL & GOSSETT

COMPANY

Dept. DA-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto

SPECIFY *ONE* WORRY-FREE PIPE . . . THAT HAS *ALL* DESIRED QUALITIES . . . MEETS ALL SERVICE REQUIREMENTS . . . LOW FIRST COST, MINIMUM MAINTENANCE.



Make Pipe Dreams come true . . . with NATIONAL

If you have been wishing you could find *one* brand of pipe that would meet *all* service requirements, it's high time you got better acquainted with National Steel Pipe. So many architects, engineers and contractors have found the National line the solution to so many piping problems—during more than half a century—that they have made National the largest selling pipe in the world.

That preference was earned by the uniform high quality and complete dependability that is built into U·S·S National Steel Pipe. From raw material to finished pipe, every step in its production is controlled by one responsible organization. Improved steel-making facilities, special manufacturing processes and the lifetime experience of many skilled craftsmen, combine to produce pipe whose metallic structure, strength, sound joints, superior welding, bending and threading properties, assure low cost installation and long trouble-free performance.

That is why shrewd pipe buyers—generation after generation—continue to specify National, whenever they need pipe. They know that it fits every purpose at a cost that fits every purse.

So, whenever you need pipe for any type of building, make your pipe dreams come true. Get U·S·S National Steel Pipe.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S NATIONAL Steel PIPE

UNITED STATES STEEL

PIPING RUNS INSTALLED

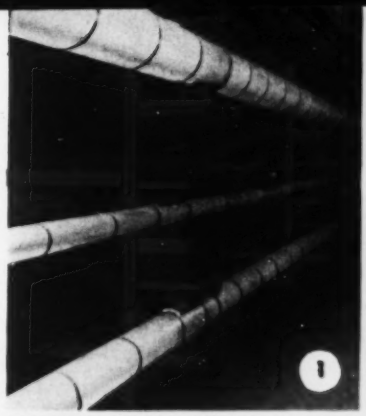
Better, Faster, for Less...

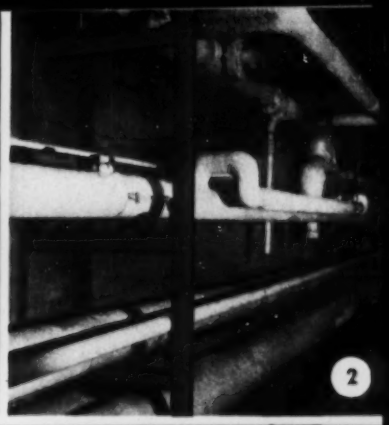
with adjustable

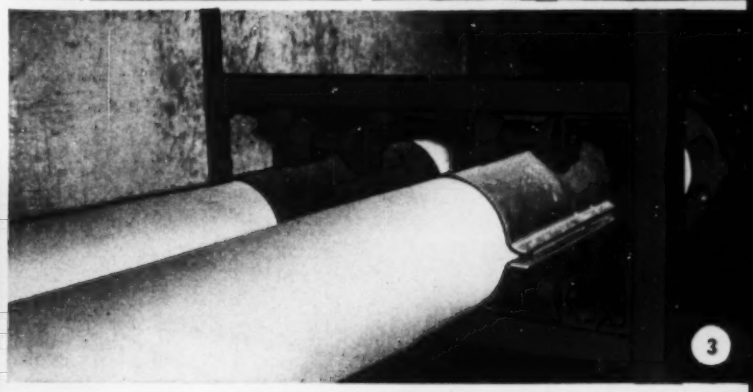
UNISTRUT®

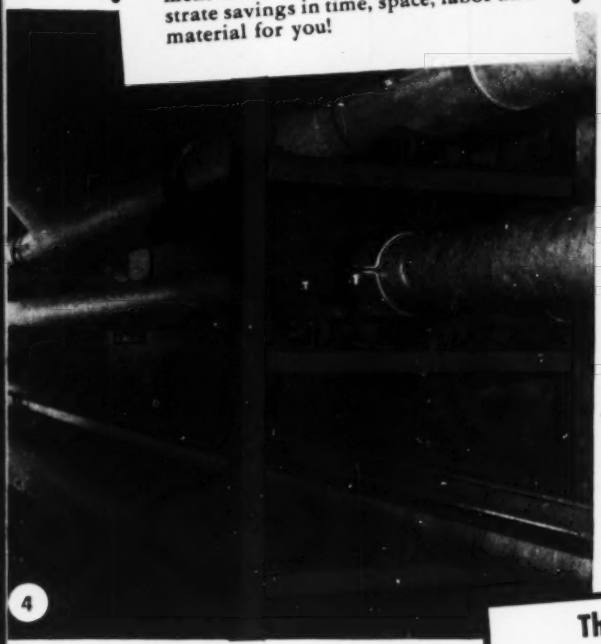
METAL FRAMING

All-purpose construction material assures exact slope or pitch, permits changes or additions at any time. Easy to erect—no special tools or equipment needed. Let UNISTRUT demonstrate savings in time, space, labor and material for you!

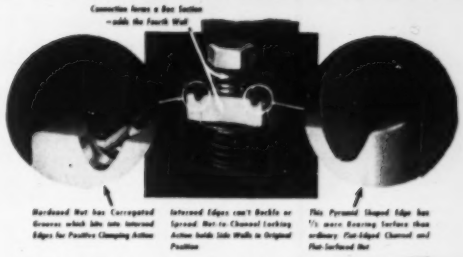








Only the UNISTRUT Framing System has this Positive Clamping Action at all Points of Connection!


Connection forms a Box Section —adds the Fourth Wall
Hardened Nut has Corrugated Grooves which bite into Interned Edges for Positive Clamping Action
Interned Edges can't Buckle or Spread. Nut-to-Channel Locking Action holds Side Walls in Original Position
This Pyramid Shaped Edge has 1½ more Bearing Surface than ordinary Flat-Edged Channel and Flat-Surfaced Nut

1 Note how UNISTRUT framework's great strength easily supports long runs of heavy piping, including bulky 16" chilled water lines.

2 Typical piping installation supported by UNISTRUT framing, concrete inserts and roller pipe supports. Slotted channel permits attachment of fittings at any desired point.

3 Steamline showing method of supporting pipe at expansion joints. Note pipes are supported above and below with UNISTRUT pipe rollers.

4 Tunnel job showing how UNISTRUT continuous run concrete inserts can be installed vertically or horizontally, or at any angle required.

UNISTRUT Products are Bonderized

Distributors and Warehouse Stocks in Principal Cities. Consult your Telephone Directories.

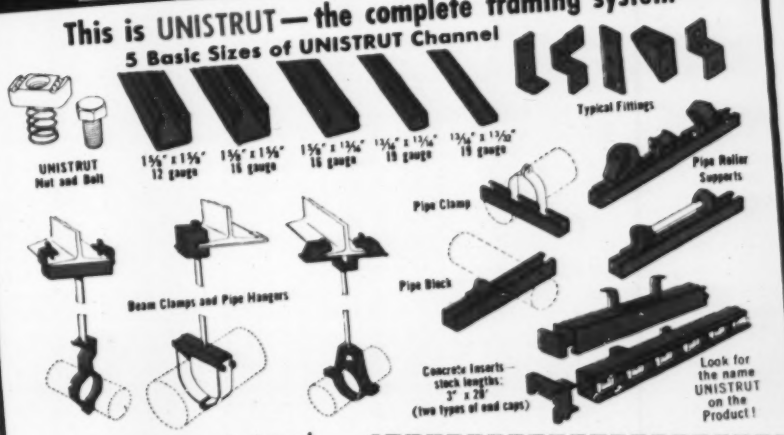
See our Catalog in Sweet's 1953 Plant Engineering, Industrial Construction and Architectural Files.

U. S. Patent Numbers

2327587	2329815	2345650
2363382	2380379	2405631
2541908	Other Patents Pending	

This is UNISTRUT—the complete framing system

5 Basic Sizes of UNISTRUT Channel


UNISTRUT Nut and Bolt
1⅝" x 1⅝" 12 gauge
1⅝" x 1⅝" 16 gauge
1⅝" x 1⅜" 16 gauge
1⅜" x 1⅜" 15 gauge
1⅜" x 1⅜" 19 gauge
Typical Fittings
Pipe Roller Supports
Pipe Clamp
Pipe Block
Beam Clamps and Pipe Hangers
Concrete Inserts—stock lengths: 3" x 28" (two types of end caps)
Look for the name UNISTRUT on the Product!

Typical stock channel, parts and fittings.

Write for NEW Free 84-page Pocket Catalog No. 800!

For the Man on the Job—packed with photos, drawings, ideas and data on how to frame, mount, rack and support electrical and mechanical equipment with UNISTRUT metal framing.

The World's Most Flexible All-Purpose Metal Framing

UNISTRUT PRODUCTS COMPANY
1013 W. Washington Blvd., Chicago 7, Ill.
Dept. H7

Please send me a copy of the new Catalog 800, without obligation.

Name_____

Company_____

Address_____

City_____ Zone____ State____

"MILLIONS of FEET of READING COPPER TUBING

Used Because of Long, Trouble-Free Service . . . Time and Labor-Saving Installation"

Says
C. WALLACE PLUMBING CO.,

One of the Southwest's Oldest and Largest Mechanical Contractors!

Founded in 1902 by Carl Wallace, now the retired dean of the plumbing industry in Texas, the C. Wallace Plumbing Co. of Dallas, Houston, and Tulsa has grown in the past 50 years to be recognized as one of America's leading plumbing, heating and air conditioning contractors. Like many other outstanding contracting firms, the C. Wallace Plumbing Co. has chosen Reading Copper Tubing for many of their largest installations.

Chief among the reasons for this widespread contractor preference for Reading Copper Tubing are its uniform wall thickness, precision quality, ease of bending and resulting reduction in number of fittings required. You can profit by the experience of these contractors and enjoy these benefits by remembering to *specify Reading Copper Tubing when you order from your plumbing and heating supply wholesaler.*

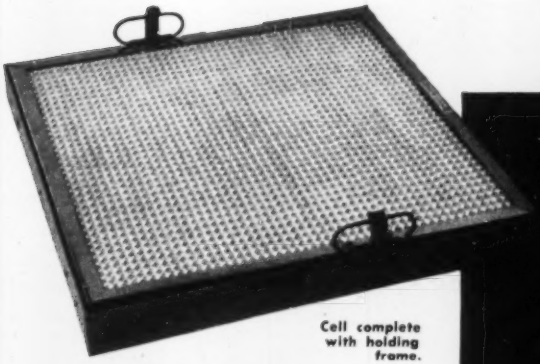
READING TUBE CORPORATION

Producers of Reading Lektroneal Copper Tubing and Reading 85% Grade A Red Brass Pipe

OFFICES AND EASTERN DISTRIBUTION DEPOT:
36-12 47th Ave., Long Island City, N. Y. • STillwell 6-9200
WORKS: READING, PA.

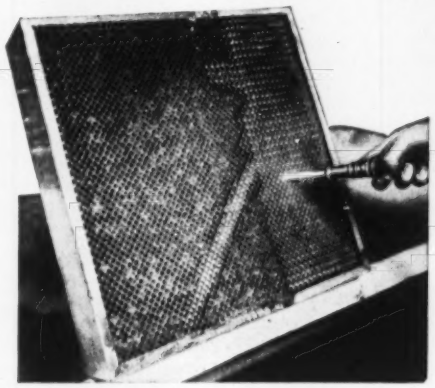
READING COPPER BRASS TUBING

DISTRIBUTION DEPOTS: Reading, Pa. • Long Island City, N. Y. • Houston, Texas, 1121 Rothwell St. Chicago, Ill., 724 W. 50th St. • Atlanta, Ga., 690 Murphy Ave. S.W. Unit 5, Bldg. B

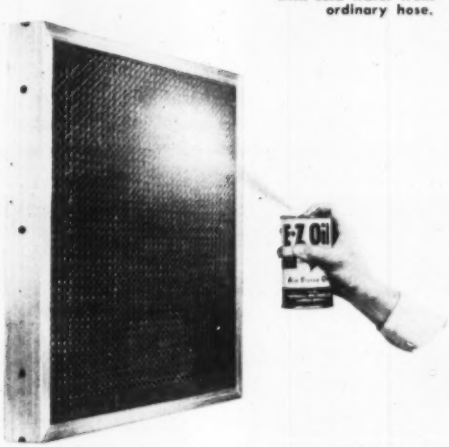


Cell complete with holding frame.

Now... Easier and Faster to Clean and Re-Oil



Unit can be quickly cleaned with cold water from ordinary hose.



Unit can be efficiently re-oiled by using E • Z • Oil Pressure Bomb.

Continental E·Z·Wash Air Filter Units . . . available in all standard sizes . . . now provide extremely high cleaning efficiency, extremely low resistance and extremely simple maintenance.

Since Continental's media affords large, smooth, non-clogging air passageways, it is practical to clean and re-oil these E·Z·Wash permanent-type units rapidly, simply and economically.

Continental E·Z·Wash filters are the only cleanable air filters which require no hot water, detergents or special cleaning tanks. Water under normal line pressure . . . an ordinary garden hose and nozzle . . . are all that are needed.

After cleaning, it is just as easy to re-oil. Simply use Continental's E·Z·Oil Pressure Bomb.

Low maintenance has always been a major advantage in Continental E·Z·Wash filters. Now it is unequalled. Write for further details.

CONTINENTAL

P.O. BOX 1647 LOUISVILLE 1, KY.

CONTINENTAL AIR FILTERS Inc.

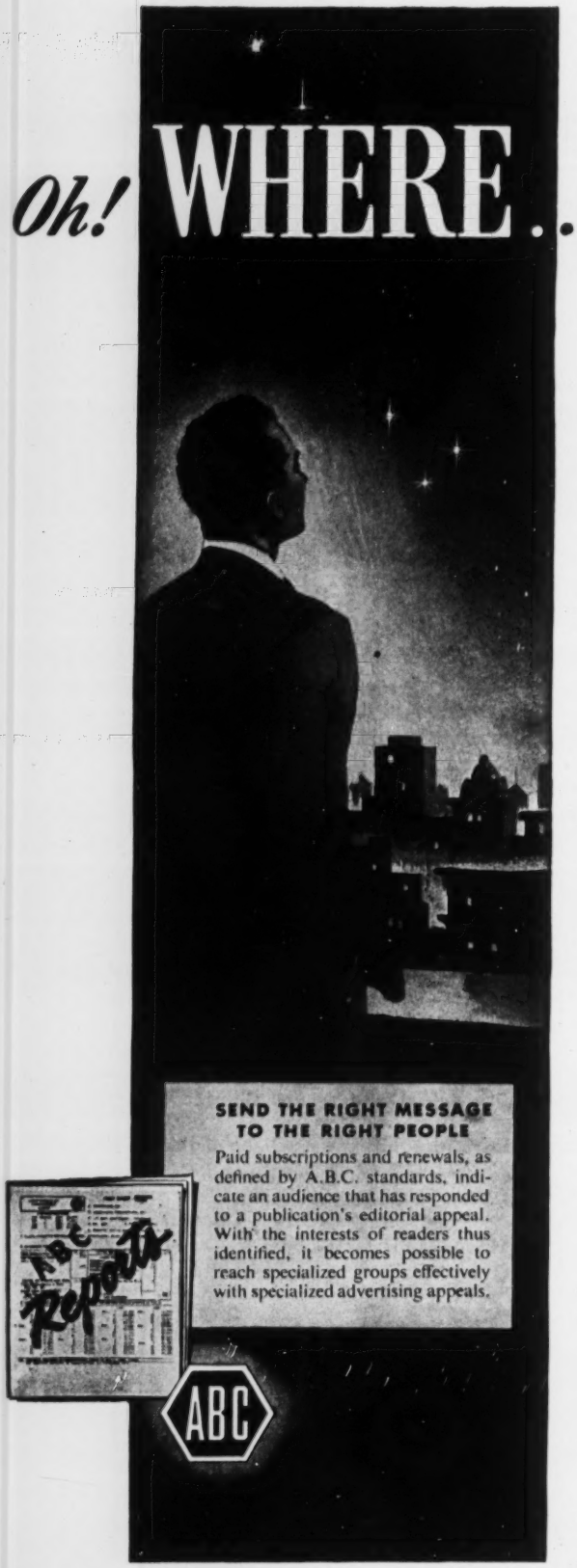
GENTLEMEN: Please send the following:
- ☐ New Bulletin No. 401-A
- ☐ Sample of E • Z • Wash Air Filter Media

NAME _____

FIRM _____

STREET _____

CITY _____ STATE _____


SEND THE RIGHT MESSAGE
TO THE RIGHT PEOPLE
Paid subscriptions and renewals, as defined by A.B.C. standards, indicate an audience that has responded to a publication's editorial appeal. With the interests of readers thus identified, it becomes possible to reach specialized groups effectively with specialized advertising appeals.
ABC

Oh! WHERE *... is my wandering ad tonight?*

THERE are two ways to buy advertising space. One is the guesswork-opinion method. The caption above is the mournful song of an advertiser who is still selecting media the way it was done before World War I, when there were no standards for the circulations of published media and when there was no accepted and approved method of auditing circulations. In those days, advertisers O.K.'d their proofs and sent out their advertising with a prayer that some of their sales messages would find their way to market.

The other way to buy space is the factual, know-what-you-get-for-your-money method. Today advertisers can start their investments on a basis of facts by selecting media with the help of the information in the reports issued by the AUDIT BUREAU OF CIRCULATIONS. This cooperative and nonprofit association of 3300 advertisers, advertising agencies and publishers, organized in 1914, has established standards that make it possible to evaluate the circulations of published media. The A.B.C. maintains a large staff of experienced and specially trained circulation auditors who make annual audits of the circulations of publisher members. A.B.C. reports give the facts thus obtained.

Here are some of the audited facts about business papers that A.B.C. reports tell the advertiser:

—how much paid circulation;
—how much unpaid;
—an occupational or business breakdown of subscribers;
—where they are located;
—how much subscribers pay;
—whether or not premiums are used;
—how many subscribers are in arrears;
—what percentage of subscriptions are renewed.

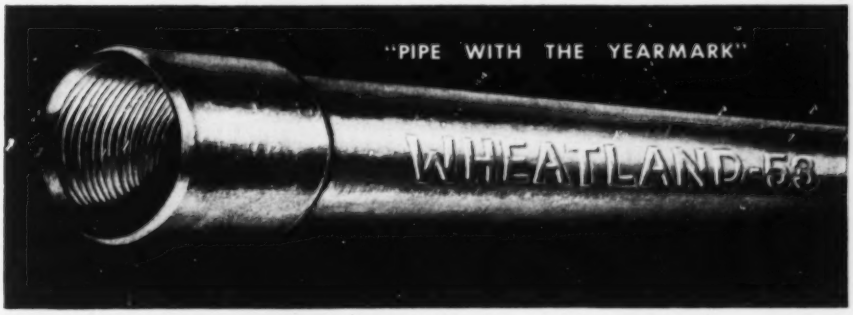
Those who buy advertising on the basis of this factual information, as given in A.B.C. reports, do not have to speculate about the distribution of their sales messages. They KNOW where and to whom their advertising goes. That is why this business paper is a member of the AUDIT BUREAU OF CIRCULATIONS. Ask for a copy of our A.B.C. report and then study it.

Heating, Piping & Air Conditioning

A. B. C. REPORTS—FACTS AS THE BASIC MEASURE OF ADVERTISING VALUE

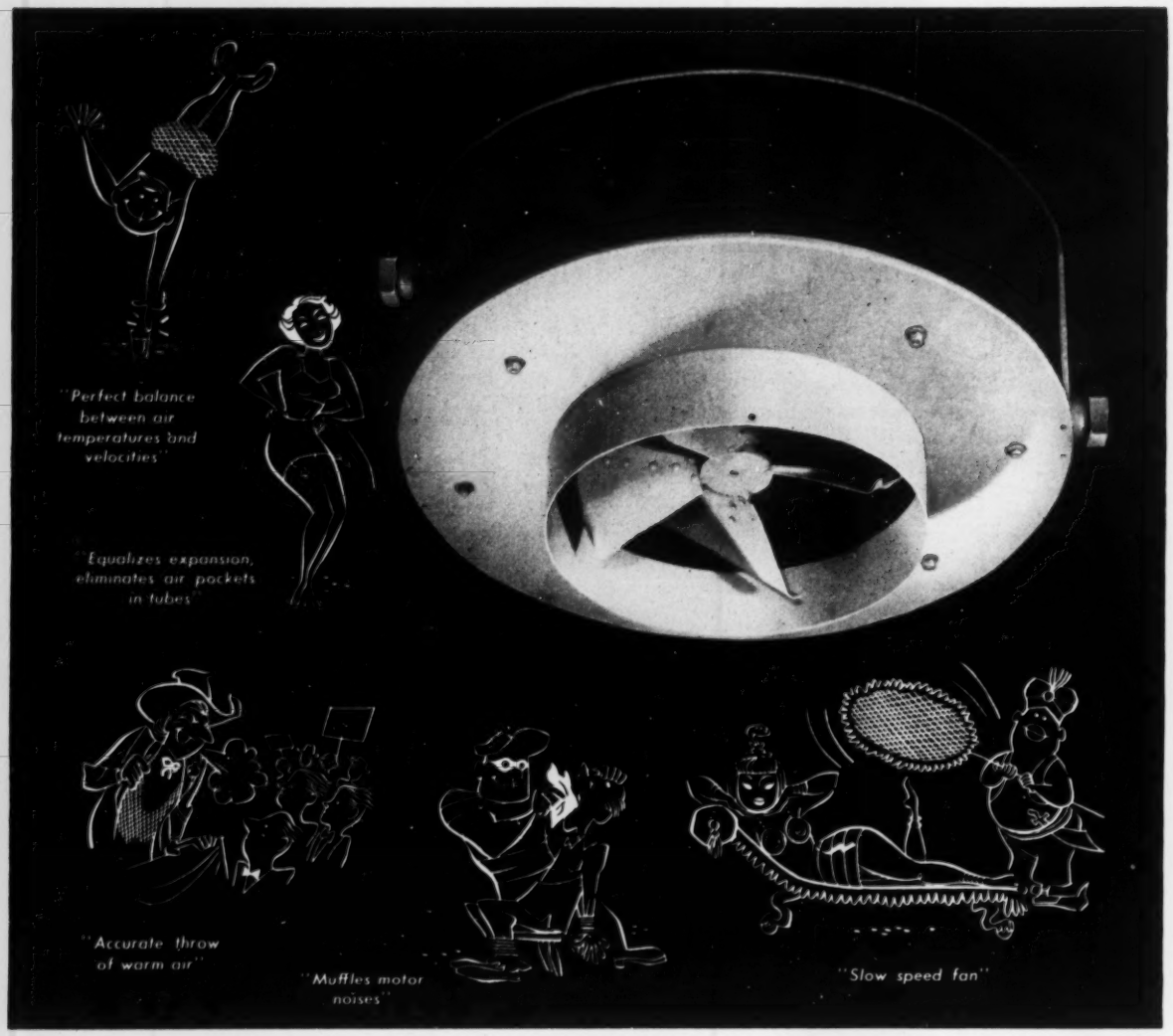
"Built-in" endurance

Nothing in nature compares with the eagle's sustained endurance in flight. For that same "built-in" strength in steel pipe, experienced specifications men depend on Wheatland—stamped with the year of its manufacture for your assurance of newest developments to produce steel pipe with "built-in" endurance.



WHEATLAND TUBE CO

BANKERS SECURITIES BUILDING, PHILADELPHIA 7, PA.


"Perfect balance between air temperatures and velocities"
"Equalizes expansion, eliminates air pockets in tubes"
"Accurate throw of warm air"
"Muffles motor noises"
"Slow speed fan"

How To Solve Your Space Heating Problems

Put in Dunham Vertical Discharge Unit Heaters and get *all* the warm air you need, *where* you need it, at temperatures that are never too low or too high. What's more, you can hang this heater in a few minutes—without putting any "support strain" on piping.

Maintenance costs are low, too. Vibration, excessive heat and dust can't get to and affect Dunham's slow speed motor. And Dunham's improved header design reduces number of solder joints, eliminates air pockets in tubing.

Dunham Unit Heaters have many other design and performance points you'll want to check. Why not check the easy way? Write for details today.

Send for Free Bulletin

Bulletin 1301-2 tells how sturdy, longer lasting Dunham Unit Heaters can solve your space heating problems. Full data on sizes, construction, capacities. For your free copy please write: C. A. Dunham Company, 400 W. Madison Street, Chicago 6, Illinois.

DUNHAM **UNIT HEATERS**

DUNHAM 1903-1953 *Quality first for fifty years*

ANOTHER QUALITY PRODUCT OF C. A. DUNHAM COMPANY—CHICAGO • TORONTO • LONDON

GRABLER

SQUARE "GEE" PIPE HANGERS

Give relief from time-wasting grief

A DOUBLE CHECK of time cost records for assembling pipe hangers with the pipe on any plumbing or heating job will show that Square "Gee" Pipe Hangers are time-cost saving tools. They are designed and fabricated to comply with modern engineering and construction practices. Grabler Pipe Hanger Catalog J illustrates and lists many types. Ask your wholesaler for Grabler Square "Gee" Pipe Hangers.

THE **GRABLER** MANUFACTURING COMPANY
6565 Broadway, Cleveland 5, Ohio

GRABLER

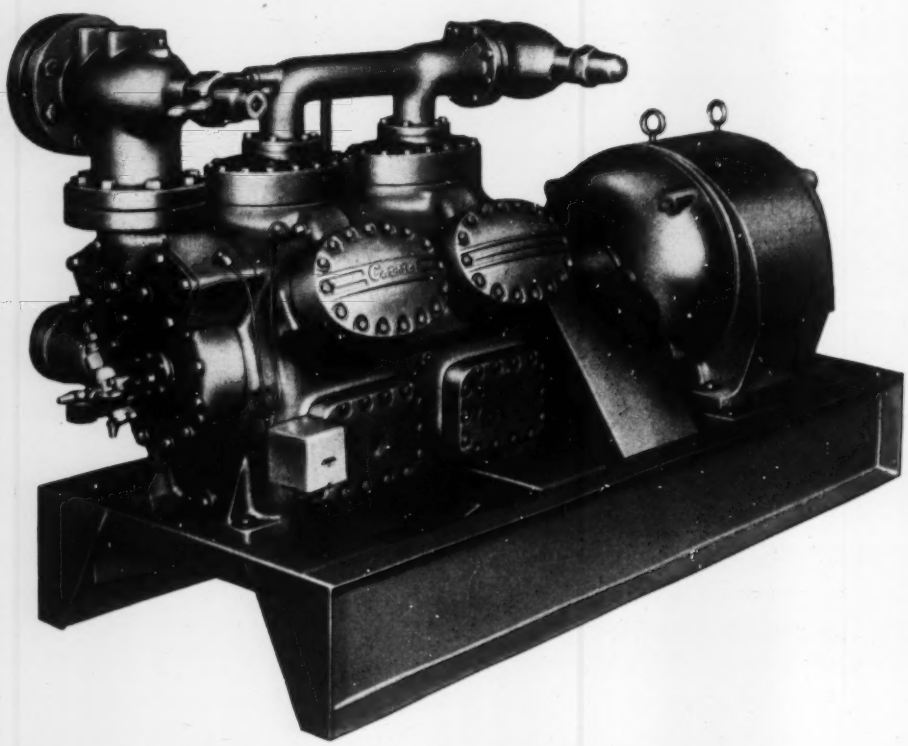
THE SQUARE "GEE" LINE INCLUDES:

Malleable Fittings, AAR Fittings, Unions, Rail Fittings, Cast Iron Steam Fittings, Cast Iron Drainage Fittings, Patented Drainage Fittings, Copper Tube Solder-Joint Fittings, Cast Brass Solder-Joint Drainage Fittings, Steel Pipe Nipples, Hangers.

WAREHOUSES: New York • Philadelphia • Atlanta • Pittsburgh • New Orleans • Dallas • Chicago • St. Louis • Minneapolis • Denver • San Francisco • Los Angeles

New 12-cylinder Carrier Compressor

simplifies installation, saves space



The new 12-cylinder, 75 to 100 hp Carrier Compressor can be driven directly by a single-shafted motor. Designed especially for air conditioning and refrigeration duty, this new unit saves floor space, makes installation easier, servicing faster.

But this new Carrier Compressor is only *one* of *eighteen* Carrier Reciprocating Compressors—ranging from 3 to 200 hp. Designed for Freon-12, Freon-22 or Carrene 7, they offer you 43 capacities to suit any job, economically.

Carrier Compressors feature: low load starting, variable capacity control, positive pressure lubrication, vapor cushioned valves, replaceable wearing parts.

These rugged Carrier Reciprocating Compressors are available to contractors through Carrier Branch Offices, Dealers and Distributors. See your Classified Telephone Directory. Or write Carrier Corporation, Syracuse, New York.

Carrier

air conditioning • refrigeration • industrial heating

FINNED TUBE

Wolverine Trufin*—the integral finned tube—presents scores of advantages. It is widely recognized for its high efficiency in heat transfer applications. It is a space-saver and a money-saver. Available in variety of sizes and fin spacings.

COPPER TUBE and COPPER-BASE ALLOY

Quality-controlled from ore to finished product. Available in a wide range of sizes to give you long, dependable service. Besides round tube, Wolverine can furnish oval, square and hexagon shapes.

STEPPING AHEAD

These tubes—carrying the distinguished Wolverine mark of top quality—are always up front.

Why are they in this leading position? What gives them their unique quality? Not men and machines alone. No, sir!

Look beyond the equipment and the guiding hands that produce these Wolverine tubes and you will realize the tireless research and development going on continuously in order that your particular tube requirements can be satisfied. We try to prepare not only for your current tubing needs but those of tomorrow as well.

We must stay ahead of the procession, ever alert to changing conditions, to be ready to meet your future needs.

You can always feel confident that Wolverine tube will lead the way to top tubing performance.

WOLVERINE TUBE DIVISION
of CALUMET & HECLA, INC.

ESTABLISHED 1916

Manufacturers of Tubing Exclusively

1419 CENTRAL AVENUE • DETROIT 9, MICHIGAN

Plants in Detroit, Mich. & Decatur, Ala. *Sales offices in Principal Cities*

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario.

*REG. U.S. PAT. OFF.

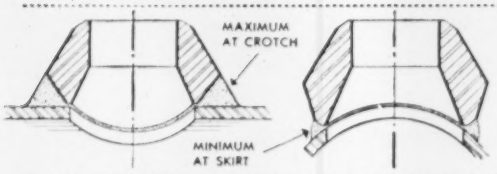
Export Department, 13 E. 40th St., New York 16, N. Y.

WELDOLET WELDING FITTINGS
MEAN PERMANENT PIPING
. . . PERMANENT SAVINGS

Here's Why

Every fitting is shaped to fit the pipe and is self-aligning.

The template is the inside of the fitting. The hole in the run-pipe can be cut out either before or after the fitting is installed.



Welded as indicated—to fill in 50° bevel at crotch, blending into 35° bevel at skirt—full reinforcement is accomplished.

The outlet is machine-beveled for quick, easy butt-welding of the branch pipe—shop or field fabrication.

Here's How

1. The WeldOlet is raised off the run pipe to establish proper weld gap, as required by Code for all types of branch connections. This is accomplished by placing spacers, e.g. welding rods, under the fitting.
2. The base joint is tack welded, preferably at four points, each half way between the crotch and skirt sections of the fitting. The spacers are then removed.
3. The stringer bead—or beads—is applied completely around the base of the fitting. The established weld gap assures full penetration.
4. Additional passes are applied as necessary to fill in the tapered base bevel of the fitting. The intermediate passes should not be continuous. Re-inforcing welds should be made at the crotch bevel area at each side of the fitting only. A continuous cover bead should be added, filling the bevel at the base of the fitting at the crotch and skirt sections.

TO COMPLETELY SAFEGUARD AGAINST:

- high pressures
- high temperatures
- internal corrosion
- external stresses

TO PROVIDE:

- improved fluid flow
- trouble-free and permanent piping systems

TO ACCOMPLISH ALL THESE THINGS IN THE MOST ECONOMICAL MANNER . . . SPECIFY AND USE

BONNEY WELDOLET WELDING FITTINGS

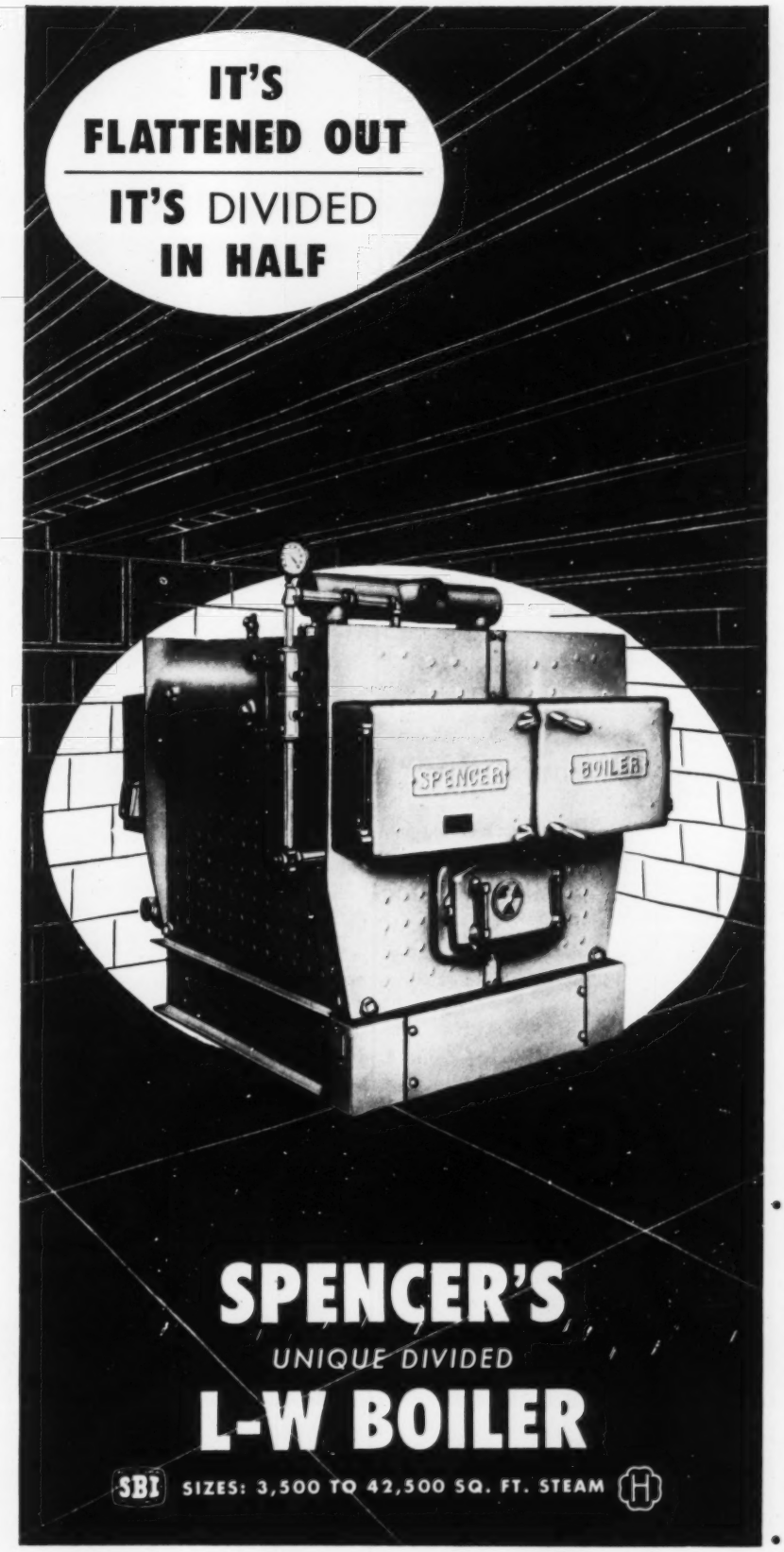
DISTRIBUTORS IN PRINCIPAL CITIES

WELDING FITTINGS DIVISION

BONNEY FORGE & TOOL WORKS

ENG. DEPT., 715 MEADOW STREET
ALLENTOWN, PENNSYLVANIA

FOR COMPLETE ENGINEERING DATA WRITE FOR YOUR BONNEY W-3 WELDOLET CATALOG.



MAJOR ADVANCE IN BOILER DESIGN

Solves Narrow Doorway and Low Headroom Problems

Because it's divided in half and flattened out, the new Spencer Low-Waterline Boiler offers unique advantages over every other boiler in the field.

In existing buildings, this boiler's exclusive divided design permits entry through narrow doorways. Though its two watertight sections can be moved in separately, they require no welding for installation.

In new buildings, it cuts excavation costs by making possible lower basement ceilings. The L-W is 25% lower than conventional firebox boilers.

It has other time-tested Spencer advantages. It's self-cleaning. It's fast steaming, thanks to staggered rows of fire tubes. It can be quickly converted from mechanical to hand firing.

Let Spencer's Low-Waterline Boiler solve your heating problems. Learn more about it today. Clip and mail the coupon below.

SPENCER HEATER
LYCOMING-SPENCER DIVISION
WILLIAMSPORT PENNSYLVANIA

Spencer Heaters—Dept. HP-73
Lycoming-Spencer Division
AVCO Manufacturing Corporation
Williamsport, Pennsylvania

Dear Sirs:

Please send additional information on Spencer's Divided L-W Boiler to:

Name_____

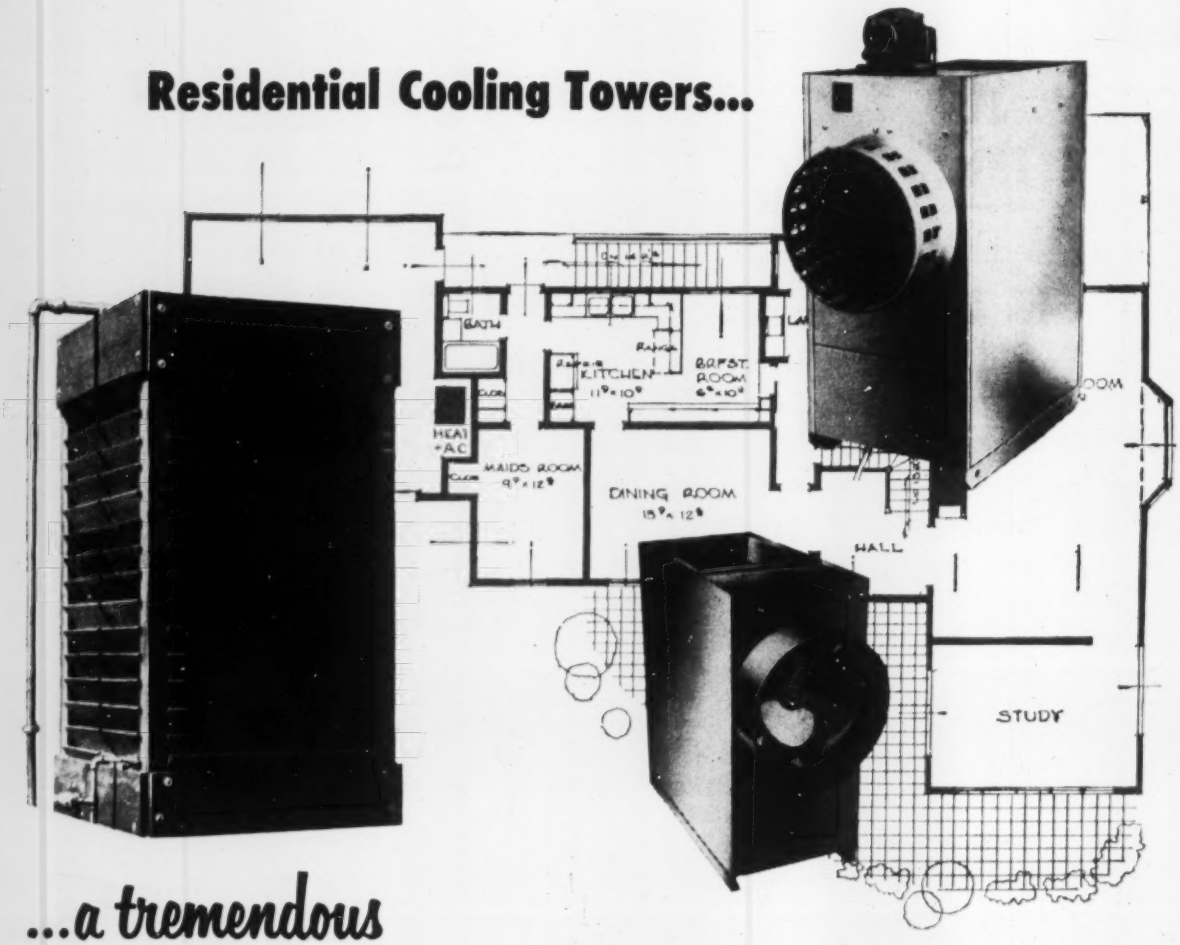
Position_____

Company_____

Address_____

City_____ Zone_____ State_____

Residential Cooling Towers...



...a tremendous new market—

and it's a

MARLEY MARKET!

The 1953 line of Marley cooling towers offers *everything* you need to cash in on the tremendous market for residential cooling towers. It's the only *complete* small-tower line—designed, manufactured, tested, guaranteed, and "presold" by the world's leading manufacturer of water cooling equipment.

If the job calls for an Aquatower,* Marley has them—a complete line of sizes and models for indoor or outdoor services from 2 to 60 tons. If you need natural draft towers, Marley has them—in a wide range of sizes and styles . . . built of only heart quality redwood . . . equipped with patented Marley non-clog spray nozzles. And whatever your requirements, you can count on over-the-counter delivery from Marley stocks in 30 cities.

To make sure that you get your share of "the Marley market," get in touch with your nearest Marley representative for expert assistance in tower selection and information on the complete Marley line.

*Registered trade mark

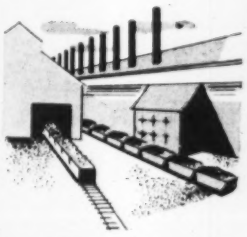
MARLEY

The Marley Company

KANSAS CITY, MISSOURI

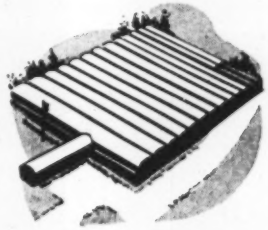
Olson

Gas, Oil, Coal or Dual Gas and Oil



INDUSTRIAL PLANTS AND FACTORIES

Olson Heaters provide instant heat automatically while it cleans the air of harmful industrial dusts. They are easily adapted to meet most any manufacturing need such as drying and high temperature work.



WAREHOUSES SHOPS AND PUBLIC BUILDINGS

Maintaining a constant temperature in large open areas is a job "cut out" for an Olson. You can also depend on them to maintain constant efficiency and low cost operation as a central system for heating and ventilating.

COMPLETE HEATING AND VENTILATING WHERE MODERN EFFICIENCY IS DEMANDED

An Olson heater is designed to do a complete job of heating and ventilating whether it be a unit or central type. Easy to install, they are factory assembled and shipped as a complete unit.

Special requirement heaters is another Olson specialty and Olson engineers always stand ready to give personal attention to your heating problem regardless of size or location.

Capacities range from 300,000 to 7,500,000 BTU per hour and an Olson Heater is really built RUGGED.

Special Adaptions

MAKE UP AIR

DRYING

HIGH TEMPERATURE

PROCESS WORK

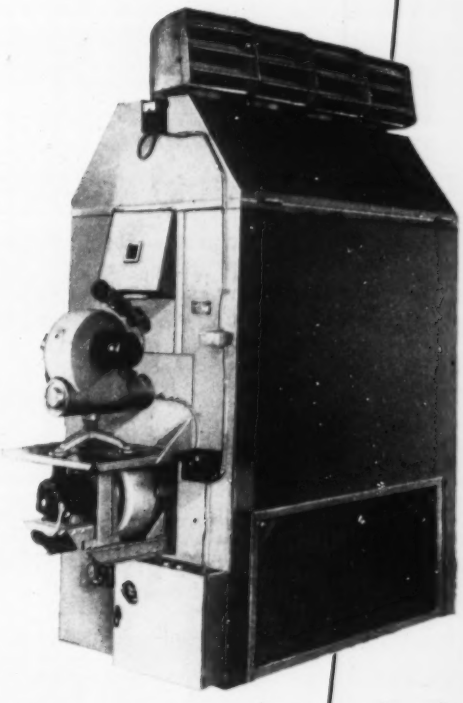
Flexibility

INVERTED SUSPENSION

HORIZONTAL SUSPENSION

DUAL SYSTEMS

PORTABLES



Get the whole Olson story. Write for catalog TODAY

Arthur A. Olson & Company
Canfield, Ohio
Please send your catalog F50.
Name .....
Firm Name .....
City ..... State .....

for motors requiring a reduced starting current

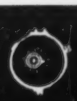
SAVE MONEY AND SPACE WITH THIS NEW STARTER

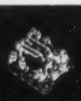
It will pay you to install these new Part Winding Magnetic Controllers to start any squirrel cage motors having two separate parallel windings, Y-connected. They will supply a reduced voltage starting characteristic, so frequently required on refrigeration compressors and large fan drives.

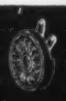
Cost of starting equipment can often be reduced by using part winding starters in place of the more expensive auto-transformer, primary resistor or reactor starters. They require only half the space of other types of reduced voltage starters with the same horsepower rating. Closed circuit starting insures minimum line disturbance and lamp flicker.

Bulletin 4340 starters are available in NEMA sizes 2 to 5 PW, maximum ratings 400 hp, 550 v, 60 cy. For complete details, write to Ward Leonard Electric Co., 24 South Street, Mount Vernon, New York. 3.8

WARD LEONARD ELECTRIC COMPANY
MOUNT VERNON, NEW YORK


RHEOSTATS


RELAYS


RESISTORS

CHROMASTER

Result-Engineered Controls Since 1892

Ward Leonard's complete engineering text book, "Handbook of Power Resistors," $3. per copy.

Highly specialized process controls are used to produce the finest in seamless WELDING FITTINGS

Only Globe, among manufacturers of welding fittings, produces its own seamless steel tubes. Specialized processes at every stage of manufacture from billet to tube — to fitting — insure uniform high quality. Thorough inspection and continuous laboratory control guarantee strict conformity to rigid specifications.

Now . . . you can get these high-quality fittings when you need them — in the quantities you want. Just get in touch with your nearest Globe distributor.

GLOBE STEEL TUBES CO., Milwaukee 46, Wisconsin
Chicago • Cleveland • Detroit • New York • Philadelphia • St. Louis
Denver • Houston • San Francisco • Glendale, Cal.

Producers of Globe Welding Fittings — Globe seamless stainless steel tubes — alloy — carbon seamless steel tubes — Gloweld welded stainless steel tubes — Globeiron (high purity ingot iron) seamless tubes.

AVAILABLE IN A COMPLETE LINE OF SIZES AND WEIGHTS THROUGH GLOBE DISTRIBUTORS IN ALL KEY CITIES

Here is one of the highly specialized manufacturing operations that insure Globe quality — piercing the billet to form a seamless tube.

Send for the Globe Welding Fittings catalog.

The type it installed in Philadelphia's luxurious Rittenhouse Claridge and Savoy?

The advanced system recommended for the St. Francis Hospital in Lynnwood, Calif.?

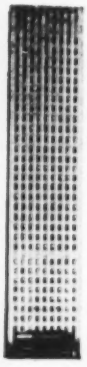
The system chosen for guest comfort in Cincinnati's famed Netherland-Plaza Hotel?

Which York system of air conditioning should you buy?

The engineering feat accomplished for New York's Empire State Building?

The battery of Turbo Compressors installed in the great new *S.S. United States*?

The all-year-comfort system chosen for the beautiful Esso Building in New York City?



YOUR BUILDING CAN TELL YOU

That's because York has taken the compromise out of air conditioning.

You see, York Engineers work with a wide range of equipment. They do not have to compromise—and try to fit a rigid system to a building or fit the building to a system.

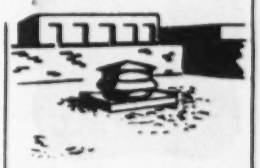
They can recommend with broad impartiality the installation that precisely suits the particular requirements of the building you are air conditioning. The result, of course, is better performance, longer life, at lower initial and operating cost.

There is a York Engineering Office near you. Give them a call. There is no obligation, naturally. Or write directly for details to York Corporation, York, Pa.

YORK AIR CONDITIONING AND REFRIGERATION
HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885

with POWER ROOF EXHAUSTERS these features are important...

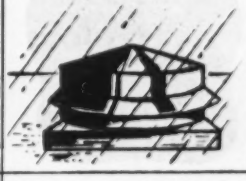
Low Installed Silhouette



Easy Installation

Heavy Construction

Weatherproof



Quality Motors

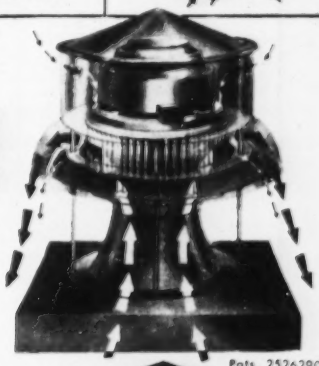
Easy Maintenance

Availability in Special Metals and Finishes

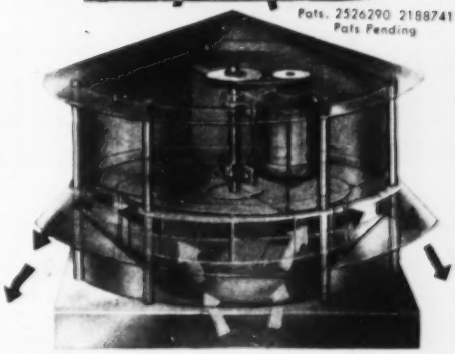
Motor out of Air Stream

but this is mandatory...

EFFICIENCY!



Pats. 2526290 2188741
Pats Pending



You expect a motor to deliver its rated power — and power exhausters are the same. If you buy a unit that does not deliver the specified air volume you are not getting what you need. You are not getting what you paid for. Gallaher's pre-design research program disclosed that efficiency above ¼" S.P. is impossible when *scroll effect* is not present and that the conventional roof exhausters suffer a drastic fall-off in efficiency as static pressures top ⅛".

From this research was developed the Air-Van®, with its patented *built-in scroll effect* and the resulting peak performance. Direct drives develop up to 42" S.P. — belt drives up to 4" S.P. The air volume of standard units goes up to 65,000 CFM, and on special order almost any volume is possible. This performance far exceeds any other power roof exhauster and it means almost every kind of industrial process demanding high efficiency can be handled by Gallaher Air-Vans®!

Your Gallaher representative can show you proof that Gallaher ratings are tested and certified correct by an independent laboratory.

Those important, yet "secondary" features? Gallaher has every one of them!

The GALLAHER Company
4108 DODGE STREET OMAHA, NEBRASKA

GENTLEMEN:

Send me full information on Gallaher Power Roof Exhausters.

NAME _____

ADDRESS _____

CITY _____ STATE _____

"WE SAVE $9,000 A YEAR—AND HEAT MORE SPACE—BY BURNING COAL THE MODERN WAY!

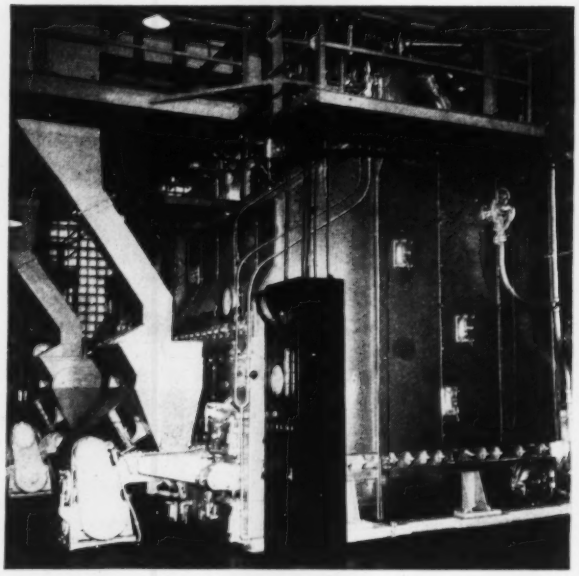
NEW COAL INSTALLATION SAVES US 31.9%—43¢—ON EVERY THOUSAND POUNDS OF STEAM!"

says Mr. Robert W. Paul, Heating Engineer, the University of Akron, Akron, Ohio.

NO SMOKE CONDITION... NO DUST NUISANCE—

this plant is located in a residential neighborhood and operates well within the bounds of extremely tight smoke and dust regulations—thanks to burning and handling coal with up-to-date equipment!

This view shows Akron's two new stoker-fired boilers. The old equipment delivered a thousand pounds of steam at a cost of $1.35. Now Akron gets a thousand pounds of steam for only 92 cents, *cutting cost by nearly* ⅓! For about $26,000 a year, this new plant does the work that would have cost $35,000 with the old one.



If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE

A Department of National Coal Association, Washington, D. C.

Planning to modernize? Building a new plant? In either case an up-to-date coal installation can save you lots of money!

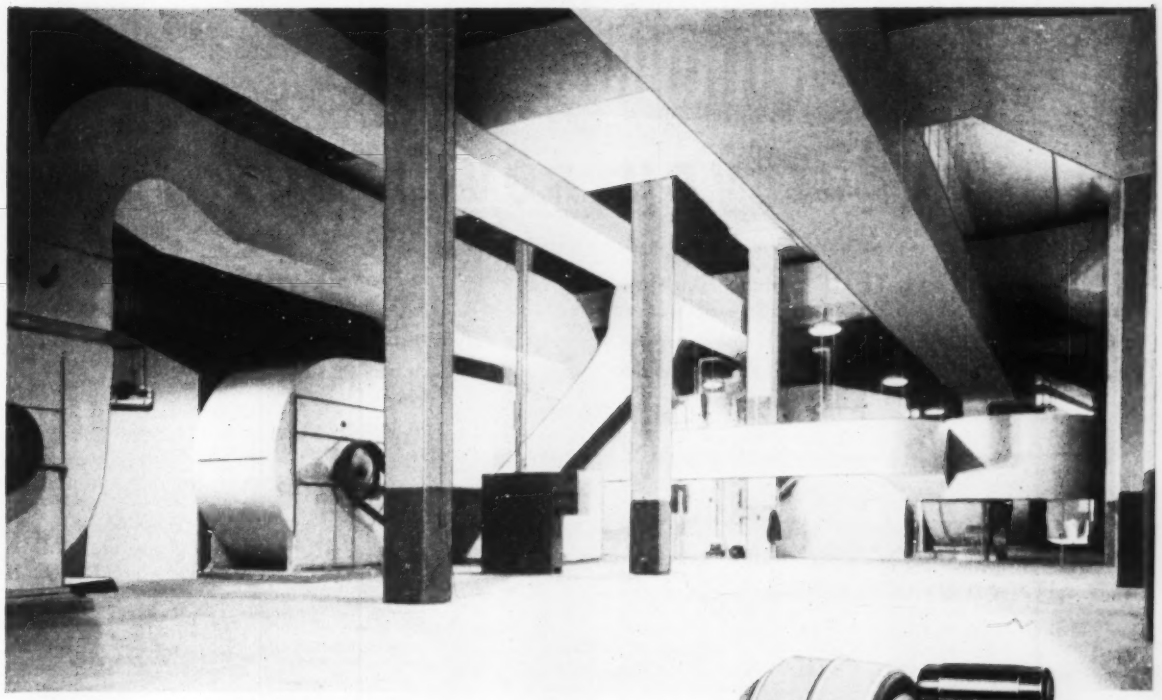
Labor costs are cut to a minimum with modern coal- and ash-handling systems . . . modern combustion equipment gives more steam per dollar—10 to 40% more power from every ton of coal!

A consulting engineer can show you how these savings really mount up—and mount up fast—when you burn *bituminous* coal in a modern plant designed to meet your *specific* needs.

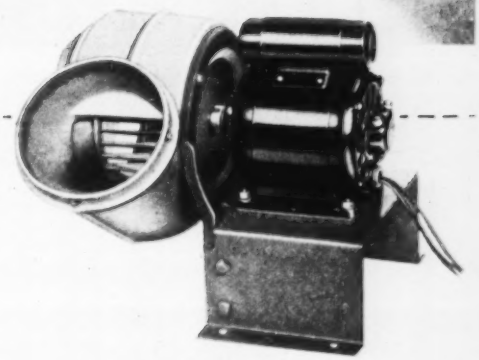
And coal's your best bet for the future, too. Of all fuels, coal alone has virtually unlimited reserves. And America's coal is mined by the most productive and efficient coal industry in the world. That's why coal offers greater price stability and more dependable supply than any other fuel!

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!



Bayley knows the whole wide field of



Bayley Direct Driven Vent Set – Type F
Write for a copy of the new Bayley Selector Guide (Bulletin VS-52-11

AIR HANDLING!

—From Mammoth Custom-Built Installations To Single "Packaged" Ventilating Units

YES, you are sure to benefit by calling upon BAYLEY engineering and service to help you solve your air handling problems. . . The ability to come up with the correct answer is a result of over fifty years of specialized experience in the field of air-handling . . . a period during which BAYLEY has won the complete confidence of leading architects, engineers, builders, and owners. Bayley Representatives in principal cities will give your requirements prompt, thorough attention.

BAYLEY BLOWER COMPANY

6600 W. BURNHAM ST. MILWAUKEE 14, WIS., U. S. A.

The GOTHAM CONVERTIBLE

a recorder you never outgrow!

The most convertible, most interchangeable, most maintenance-saving instrument you've ever seen.

Deliberately designed so that the basic elements are identical for the 6", 9" and 12" chart size recorders. Temperature and pressure systems are also completely interchangeable. This flexibility enables you to convert instruments to suit your changing needs, at a minimum cost, minimum inventory, and without delay at the job site. Control through air relay or solenoid easily added. Full details in Catalogs 400 and 500.

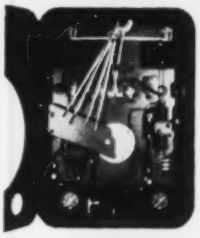
What you can do with the Gotham Convertible

Function	Chart Size 6"	9"	12"
1-Pen Recorder	X	X	X
Single Temperature or Pressure Controller, Indicating	X	X	X
2-Pen Recorder*		X	X
3-Pen Recorder*			X
4-Pen Recorder*			X
1-Pen Recorder-Controller		X	X
2-Pen Recorder-Controller*			X
1-Pen Recorder-Controller and 1-Pen Recorder *			X
1-Pen Recorder-Controller and 2-Pen Recorder *			X

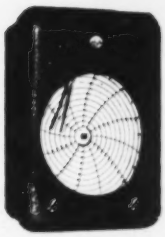
Functions above may be either Temperature or Pressure or Mixed (*)

IT'S A TEMPERATURE RECORDER

IT'S A PRESSURE RECORDER



IT'S A TEMPERATURE OR PRESSURE RECORDER AND CONTROLLER



EXTERIOR OF THE GOTHAM CONVERTIBLE

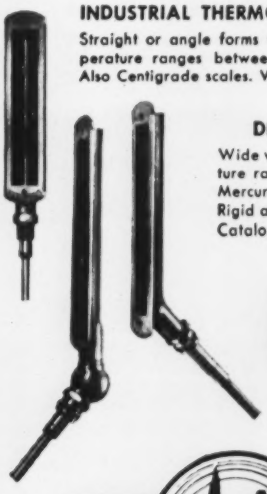
AUTOMATIC TIMING CONTROLLER

Multiple cam type, designed to start and control a sequence of process operations. Opens or closes air valves or electric switches. Available in single cam type. Write for Catalog 500.

RECORDING PSYCHROMETER

Wet and dry bulb. Motor driven suction-type blower. Standard chart drive. Similar design available for Recording and Recording-Controlling Hygrometers. Write for Catalog 400.

PORTABLE RECORDERS—Handy, light-weight, mercury or vapor actuation, 6", 9", 12" chart sizes. See Catalog 400.

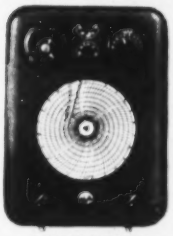


INDUSTRIAL THERMOMETERS

Straight or angle forms for all purposes. Temperature ranges between —40°F. and 950°F. Also Centigrade scales. Write for Catalog 100.

DIAL THERMOMETERS

Wide variety of case styles, temperature ranges, connections and fittings. Mercury, vapor, or gas-actuated. Rigid and adjustable stems. Write for Catalog 200.



PROGRAM CONTROLLER

Controls either temperature or pressure vs. time. Controls and records time, rate of rise, hold value, and rate of cooling. All adjustments in this new instrument made from outside of case. Write for Catalog 500.

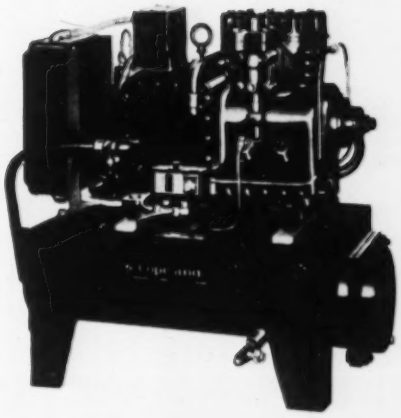
Keep Everything Under Control With Gotham

GOTHAM INSTRUMENTS

Division of AMERICAN MACHINE AND METALS, INC.
Dept. 7, Sellersville, Pennsylvania

COPELAMETIC

THE *Accessible* HERMETIC



Cutaway of 7½ H.P. COPELAMETIC Motor-compressor

fits into any air conditioning plan

Whether it's a room air conditioner, a large package unit or a huge factory system, COPELAMETIC is your answer to the question "Which refrigeration unit shall I recommend for the air conditioning system?" COPELAMETIC has become the standard of comparison for dependability, ruggedness, compactness and long life. Your clients will appreciate the COPELAMETIC design which eliminates belts, seals and manual oiling . . . reasons for 9 out of 10 service calls. Better yet, they'll appreciate the practical feature of accessibility.

Air-cooled, remote COPELAMETICS are built from ¼ thru 3 HP. There are also water-cooled, remote units from ⅓ thru 7½ HP. Self-contained COPELAMETICS are available for all applications. Write for Condensed Catalog C-52

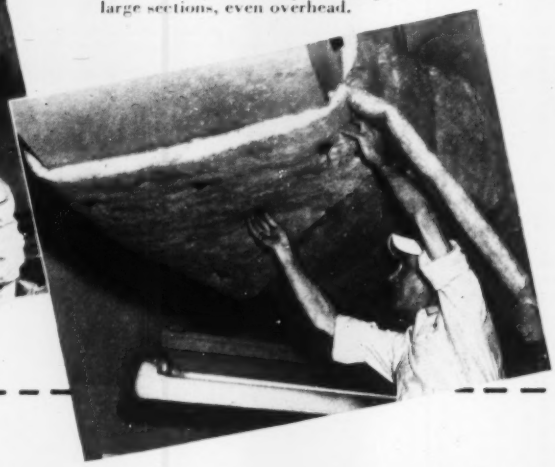
REFRIGERATION UNITS
(OPEN TYPE AND COPELAMETIC)
WATER COOLERS

Copeland
DEPENDABLE *Electric* REFRIGERATION

COPELAND REFRIGERATION CORPORATION, SIDNEY, OHIO

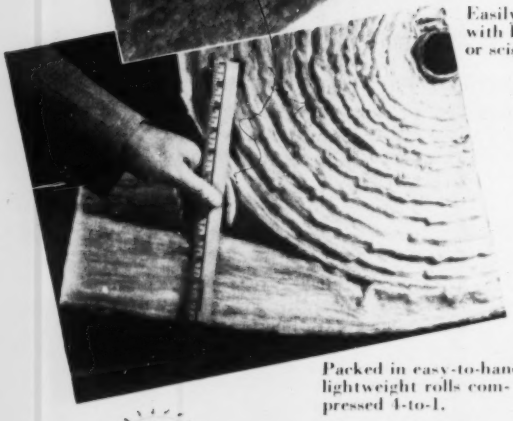
Flexible MICROLITE blanket conforms readily to irregular shapes.

Extremely light in weight with good tensile strength for easy handling in large sections, even overhead.



When you've got ducts to wrap...

You'll save time— You'll do it easiest— with MICROLITE



Easily cut with knife or scissors.

Packed in easy-to-handle, lightweight rolls compressed 4-to-1.

MICROLITE *Glass Fiber Insulating Wool* is a natural for wrapping ducts. It's soft—it's resilient—it's pleasant to handle—it's easy to cut.

Extreme light weight of Microlite minimizes attachment and mounting points—without danger of insulation sag. Weighing only ½-pound per cubic foot, enough B-305 Microlite to provide 1″ of insulation on a 1′ x 2′ x 100′ duct weighs only 50 pounds.

Inch for inch, Microlite is one of the most effective of all insulating materials. Half-pound density Microlite has a "k" factor of .25 at 50° mean; a Noise Reduction Coefficient for 1″ thickness of .60. You can't conscientiously proceed with any insulating job until you've investigated Microlite, a product of Glass Fibers exclusive electronic-extrusion process. Write for descriptive Microlite brochure and detailed duct application manual. Glass Fibers Inc., 1810 Madison Avenue, Toledo 2, Ohio.

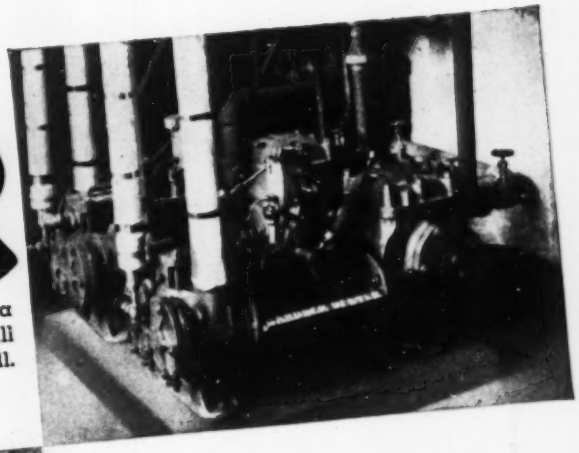
GLASS FIBERS INC.

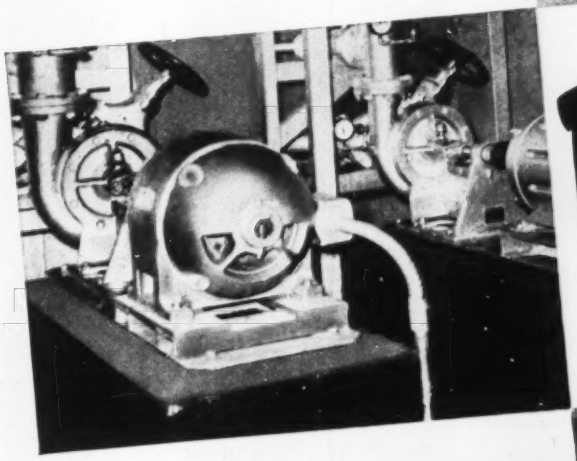
Makers of glass fibers by the ELECTRONIC-EXTRUSION process—developed, patented and used exclusively by Glass Fibers Inc.

VITRON Yarns • Rovings • Micro-Fibers • Pipe Wraps • Industrial Mats • MICROLITE Thermal and Acoustical Insulation
DURAMAT Vapor Barriers • VIBRAGLASS Mounting and Packaging Materials • COUSTIC-AIRE and THERMO-JET Aircraft Insulations.

POWER

Installed in a New Orleans plant in 1907, a Gardner-Denver Duplex Pump like this is still in use—is still called the best pump in the mill.



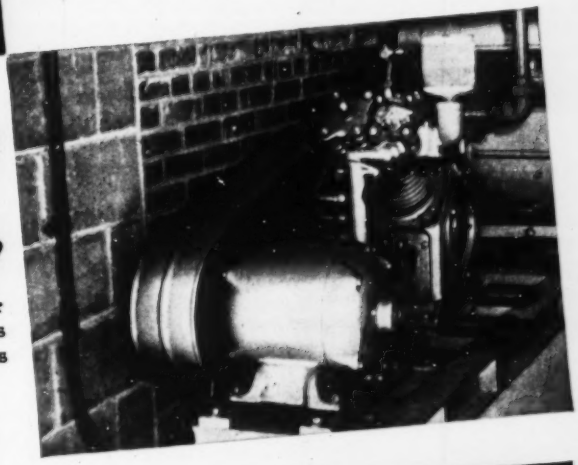


ROOM

A midwest water works reports it has operated a Gardner-Denver Centrifugal Pump for 17 years, with no repairs.

TALK

In a Canadian laundry, a Gardner-Denver Air-Cooled Compressor has run for 8 years steady—without even having the valves cleaned.



TELLS THE STORY OF...

CUSTOMER SATISFACTION WITH GARDNER-DENVER EQUIPMENT

Send for descriptive bulletins.

SINCE 1859 **GARDNER-DENVER**

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd.,
14 Curity Ave., Toronto 13, Ontario

THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

"Our Country's Strength is Created . . ."

REESE H. TAYLOR
President, Union Oil Company of California

"Our country's strength is created by the responsibility and solidarity of individual citizens in a self-chosen government and economy. It can—and must—be perpetuated against all who seek to undermine it. The men and women who invest regularly in United States Defense Bonds are contributing to our national integrity and to the traditions of personal independence so characteristic of a free people."

Every pay day, 6,500,000 employed men and women . . . "are contributing to our national integrity and to the tradition of personal independence . . ." by the systematic purchase of United States Defense Bonds.

How important is this contribution to national economy and personal security? Let's look at a few figures.

- the cumulative purchases of 6,500,000 Payroll Savers add up to $130,000,000 per month.
- the number of individual E Bonds sold in 1951 totaled 68,069,000 pieces—8% more than in 1950.
- purchases of $25 and $50 E Bonds—the denominations popular with Payroll Savers—were greater than the sales of $500 and $1,000 E Bonds.
- monthly redemptions of unmatured E Bonds during each of 9 months (April to December, 1951) were less than 1% of the amounts outstanding.
- the *cash value* of Series E Bonds held by individuals on December 31, 1951, amounted to $34,727,000,000—$4.8 billions more than the cash value of Series E's outstanding in August, 1945.

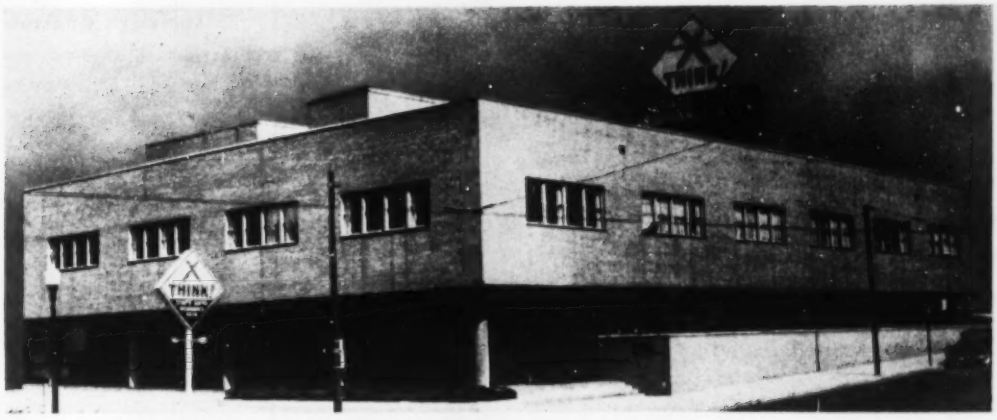
That Americans have built personal security and a reservoir of purchasing power exceeding $34.7 billions is due in no small measure to the patriotism and foresight of men like Mr. Taylor and other leaders of industry who have made the Payroll Savings Plan available to their employees.

For help with your Payroll Savings Plan, phone, wire or write to Savings Bond Division, U.S. Treasury Department, Suite 700, Washington Building, Washington, D. C.

The U.S. Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the Advertising Council and

Heating, Piping & Air Conditioning

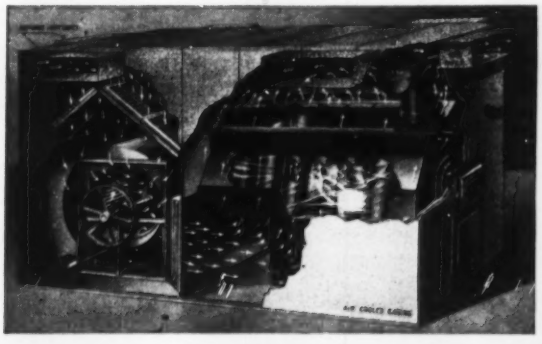
WARM AIR HEATED... by Campbell



State Automobile Insurance, Home Office Bldg., Des Moines, Iowa. Campbell Warm Air Unit installed on roof in combination with cooling equipment for year 'round air conditioning. Architects, Brooks-Borg, Des Moines. Wm. E. Names, Consultant. Heating Contractors, Conditioned Air Corp., Des Moines.

OUTSTANDING FUEL ECONOMY

Campbell No. 8000 Heaters make it easy and practical to use warm air heat in large multi-room buildings. The exceptional efficiency of the units assures outstanding fuel economy. Cost of the heating unit and installation are both surprisingly low; especially when the heating system is installed in conjunction with summer air conditioning. Give Campbell Warm Air Heating Engineers an opportunity to figure on your next large heating job.



MANUFACTURERS' AGENTS

We have a number of attractive openings for manufacturers' agents who call on heating contractors and architects. If interested, please state territory you cover.

CAMPBELL HEATING CO.
Des Moines 17, Iowa
I am interested in your proposition for manufacturers' agents.
My territory covers.....
NAME.....
ADDRESS.....
CITY.....ZONE.....STATE.....

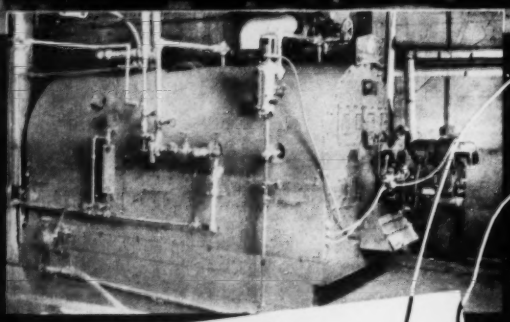
CAMPBELL HEATING COMPANY

Des Moines 17, Iowa

DUTTON *EconoTHERM* BOILER NOW "Cutting Our Cost of Operation"

says Consumers Company of Racine, Wisconsin

(A well-equipped, all-modern firm, as you can see!)



Dutton representative in this area.

Yes — EconoTherm's off-center firing creates positive water circulation for faster steaming, steadier water line, greater safety. FIVE square feet of heated surface per H.P. insures plenty of capacity.

There's a big saving in EconoTherm's automatic operation through electronic controls. Instead of a man's full time, boiler requires just a few minutes' checking daily.

With EconoTherm's induced draft fan, you not only eliminate chimney expense, but avoid hot gas "blow-backs" in boiler room! Rotary combustion is clean and highly efficient.

To keep every Dutton EconoTherm owner equally pleased is the full-time aim of our engineers, field service men and representatives.

Consumers Company

READYMIXED CONCRETE — SAND-STONE-GRAVEL

RACINE, WISCONSIN

October 9, 1952

Braun-Kerr Hardware Co.
1526 Indiana Ave.
Sheboygan, Wis.

Attn: Mr. R. C. Braun

Gentlemen:

Since we have installed a Hapman-Dutton boiler we are enjoying for the first time a constant source of steam heat which more than takes care of our needs at our Readymixed Concrete Plants.

This boiler replaced an old hand-fired coal boiler which required a man to operate it at all times during our daily winter operation.

With our new boiler we have eliminated a costly smoke stack which was replaced every five or six years. We have also eliminated all dirt, soot and ashes which keeps our plant much cleaner. The boiler is completely automatic, eliminating a man and cutting our cost of operation.

It is our opinion that we have made the ideal selection of the type and kind of oil burner to give us adequate steam heat at all times for our plants.

Yours very truly,

CONSUMERS COMPANY

Robert Wayland

Robert Wayland

To cut *your* operating cost—and *increase* all-around satisfaction—contact your Dutton representative.

WRITE FOR NEW ECONOTHERM BULLETIN EC-52G.

Dutton BOILERS CHECK FIRST with Dutton

KALAMAZOO, MICHIGAN • DIVISION HAPMAN-DUTTON COMPANY

BOILER BUILDERS SINCE 1880

FOUR TYPES — SIZES FROM 5 to 250 h.p.

Got a job for a young fellow with about 90,000 years' experience ?

That's a lot of experience for a young fellow, but this particular young fellow happens to be the current model of the McDonnell No. 47-2 Feeder-Cut-off Combination. No other fellow doing his kind of work has so much experience to draw upon or such a great background to cite. That's why he's the most dependable guy you can put on the big job of safeguarding steam heating boilers from low water. Let's look at his qualifications:

BACKGROUND

1 "Cool Feed Valve"

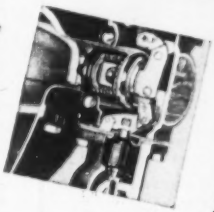
A lineal ancestor of the present No. 47-2 was first to have the working parts isolated from the heat of the boiler so that scale — toughest foe of feeder dependability — *can not* form at the feed valve. This revolutionary feature was developed and patented in 1929.

2 "Quick-Hook-Up"

Another "first" was this provision for installing a feeder right in the gauge glass tappings. This is the only accurate way to reproduce the boiler water level in the float chamber of a feeder installed on a small boiler. It is also the quick, dollar-saving way . . . hence the "Quick-Hook-Up."

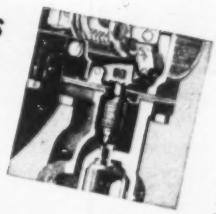
3 "Double Sylphon"

The headaches caused by packing and stuffing boxes were cured "way back when" the stuffing boxes were replaced with Sylphon bellows in McDonnell boiler feeders.



4 "Straight Thrust" Stainless Steel Valves

McDonnell feed valves were and are the first precision-ground stainless valves. Years ago a roller and slot toggle was developed that assures a true, non-binding seating. This is a costly, but vital feature.



5 Deep Sediment Chamber

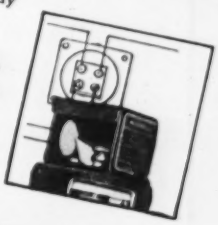
Long ago we provided a deep sediment chamber as added protection for people who neglect the blow-down instruction. Another McDonnell extra value.

6 "Straight-Through Blow-Off"

We gave up using standard globe valves for two good reasons. First, to provide a quick-acting, wide-open passage to sluice out all sediment. Second, to provide the large discharge capacity necessary to lower the level in the float chamber for testing float and switch action. Insurance companies recommend it. The valve is self-closing, too—no worries about draining boiler and wasting water because somebody forgets.

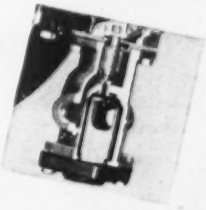
7 McDonnell-Built Switch

To make sure that the low water fuel cut-off always works right, the switch used in the No. 47-2 is built down to the last detail in the McDonnell plant. It's a snap-action switch that always snaps.



8 Large Built-In Strainer

One of the reasons for McDonnell dependability is the big, generous, integral strainer. It is flange mounted for easy removal.



References

That is the background. References are the nation's foremost authorities on boiler safety . . . engineering codes . . . boiler insurance companies . . . Underwriters' Laboratories . . . independent testing laboratories. And the greatest reference of all — the majority approval of heating engineers and contractors everywhere!

Your Jobber Stocks Them

McDONNELL & MILLER, Inc.
3500 N. Spaulding Ave., Chicago 18, Ill.

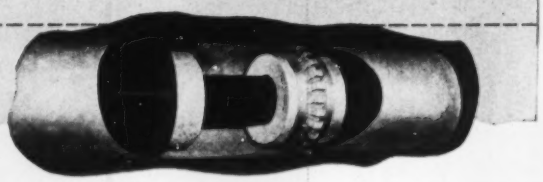
Pre-Fabrication makes a D.I.P. Conduit System Easy to Install

Here's what 2 Contractors say about DURANT INSULATED PIPE:

1. A superintendent had this to say about an air force job involving a large amount of D. I. P.: "All D. I. P. went in place exactly according to the Durant drawing except for one change: we had to cut off about 2" on one pipe." The superintendent also stated that, in his opinion, "if any contractor ever put in D. I. P. and had had experience with other types of underground pipe, that contractor would install *only* D. I. P. in the future."

2. A mid-western contractor said this about a D. I. P. installation: "On our job at J....., the D. I. P. went in perfectly: we had no trouble whatever. Furthermore, in the Spring a year ago, that area was flooded and the entire installation was under water for several months. This past Winter no trouble occurred in the D. I. P. system in spite of the flooding."

D. I. P. expansion loops. Pipe being welded prior to completing field joint.



D. I. P. railroad installation.

Many advantages come with D. I. P.: Installation costs are extremely low because this conduit can be laid on the bottom of a graded open trench. No external casing welding, no drains, tile, concrete tunnels, nor special tools or equipment are needed. D. I. P. does not require additional protection for superimposed loads—such as under roads or tracks. And D. I. P. is the *only* pre-sealed insulated conduit not dependent on a metal jacket for protection from moisture and corrosion: a 1" layer of asphalt is the water-proofing protection.

Our new major Catalog 7-A is about to come off press. May we have your name and address so we can mail you a copy?

Representatives in Principal Cities

PRE SEALED

Western Division: **DURANT INSULATED PIPE COMPANY**
DEMETER STREET OFF BAY ROAD, PALO ALTO, CALIFORNIA

Eastern Division: **DURANT INTERNATIONAL CORPORATION**
WILLIAMSTOWN, NEW JERSEY

MADE TO BE QUIET!

Chrysler Airtemp "Packaged" Air Conditioning is designed and engineered to give QUIET operation. This allows the unit to be installed nearer to room occupants without disturbing them. It may mean less ductwork . . . greater installation economy.

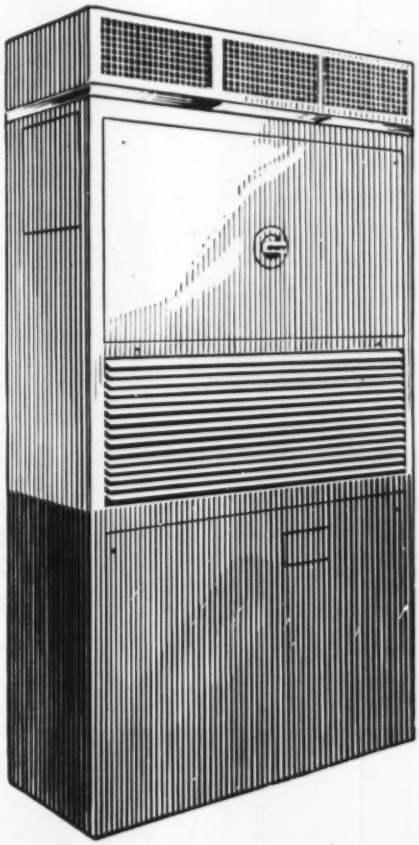
But that's not all! Quietness and freedom from vibration contribute to long life and years of trouble-free service.

Here are just three of the many reasons for the amazingly quiet performance of Chrysler Airtemp Packaged Air Conditioning:

- Vibration is reduced to a minimum in the compact radial compressor, because the compressor design permits perfect balance regardless of the number of cylinders.
- Transfer of any noise or vibration within the air conditioner is prevented by flexible connections in both the suction and discharge lines.
- For super-quiet performance the compressor is supported from rubber mountings. There is no metal to metal contact.

Get all the facts today. See why it will pay you to sell the "Packaged" Air Conditioning most people buy—Chrysler Airtemp!

Comfort Zone FOR PROFIT



"Packaged" Air Conditioners
Six water-cooled models 2 to 15 H.P. and 2 and 3 H.P. air-cooled models meet most cooling needs.

Guaranteed by Good Housekeeping

Chrysler Airtemp

HEATING • AIR CONDITIONING
***for* HOMES, BUSINESS, INDUSTRY**
Airtemp Division, Chrysler Corporation, Dayton 1, Ohio

Airtemp Division, Chrysler Corporation HP&AC 2-53
P.O. Box 1037, Dayton 1, Ohio

Please send full details on the Chrysler Airtemp Comfort Zone "Packaged" Air Conditioning proposition.

Name _____

Address _____ *Phone* _____

City _____ *Zone* _____ *State* _____

AEROFIN

Heat-Transfer Surface

Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

● High Efficiency

● Long Service Life

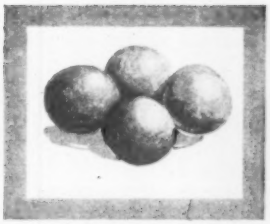
● Low Maintenance Costs

You are assured of high efficiency in heating or cooling — long service life — low maintenance and service costs, when you specify Aerofin extended-surface heat exchangers.

The reason is obvious: Aerofin makes heat exchangers *exclusively* — offers you the results of unequalled experience, unequalled production facilities, unequalled materials testing and design research — and the guidance of a complete, highly skilled engineering staff, at the plant and in the field.

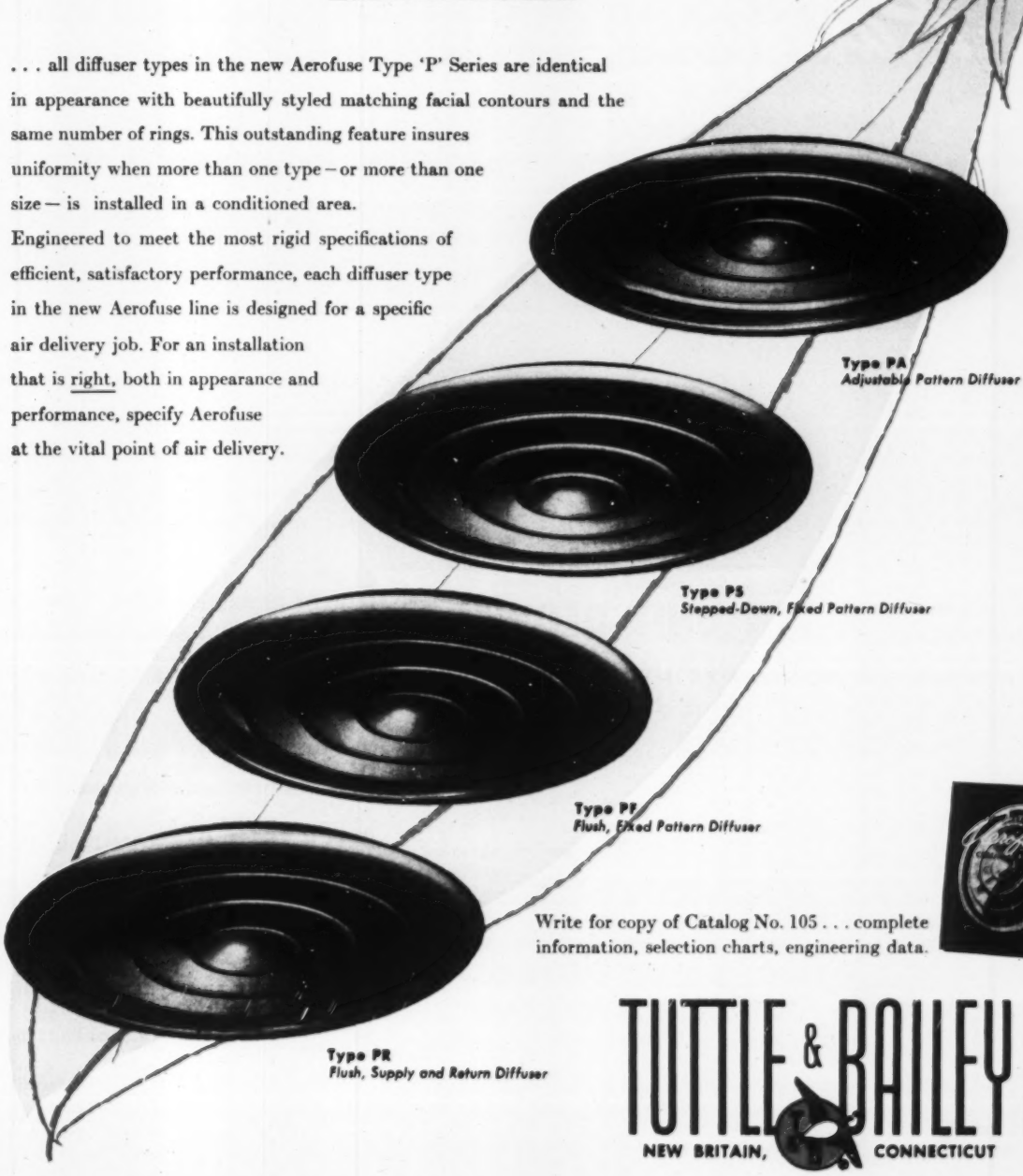
For the most practical solution to your heat-exchange problem, ASK THE AEROFIN MAN.

AEROFIN CORPORATION 410 South Geddes St. SYRACUSE 1, N. Y.

Like  in a pod...

. . . all diffuser types in the new Aerofuse Type 'P' Series are identical in appearance with beautifully styled matching facial contours and the same number of rings. This outstanding feature insures uniformity when more than one type – or more than one size – is installed in a conditioned area.

Engineered to meet the most rigid specifications of efficient, satisfactory performance, each diffuser type in the new Aerofuse line is designed for a specific air delivery job. For an installation that is right, both in appearance and performance, specify Aerofuse at the vital point of air delivery.



Type PA
Adjustable Pattern Diffuser

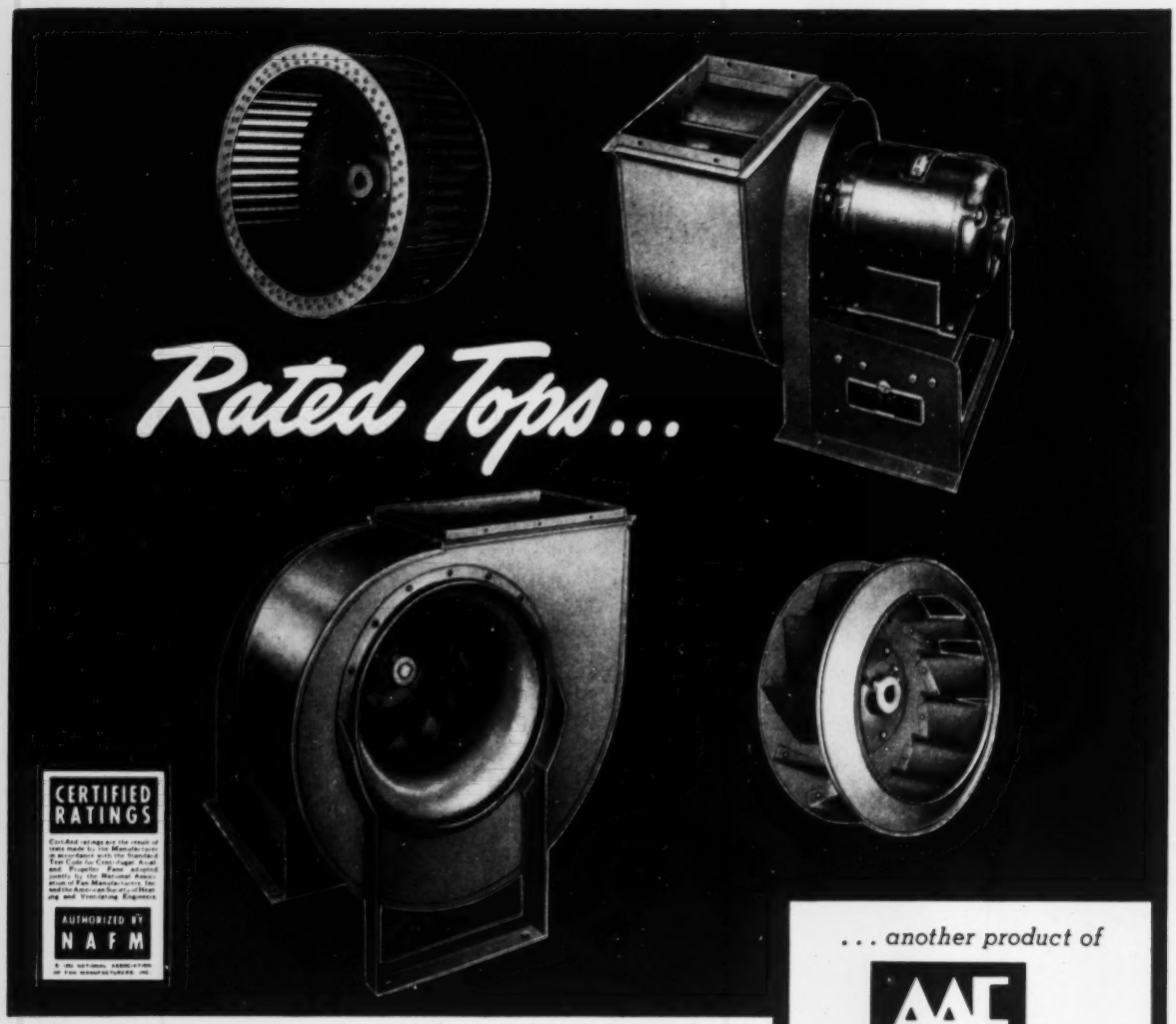
Type PS
Stepped-Down, Fixed Pattern Diffuser

Type PF
Flush, Fixed Pattern Diffuser

Type PR
Flush, Supply and Return Diffuser

Write for copy of Catalog No. 105 . . . complete information, selection charts, engineering data.

TUTTLE & BAILEY inc
NEW BRITAIN, CONNECTICUT



HERMAN NELSON UNIT BLOWERS

offer industry the most diversified selection of packaged Centrifugal Fans available

Herman Nelson offers you both Direct Drive and Belt Drive models—forwardly curved slow speed models or backwardly inclined non-overloading models. Each is designed for a specific job—a job it will *do better* because it's *built better!*

You can't buy a better unit blower and here's why. The wheel construction is rugged and highly efficient *and* the wheels are statically and dynamically balanced.

Herman Nelson offers completely self-contained units including motors. Every unit is compact in design and fits into small spaces. Smartly designed . . . Herman Nelson unit blowers are attractive in appearance as well as practical on the job.

There are 103 models to choose from with rated capacities ranging from 360 to 18,300 cfm. *Every* Herman Nelson Unit Blower carries the N.A.F.M. Certified Performance guarantee.

Specify Herman Nelson—and make certain you get the best Unit Blowers your money can buy. Write for complete information on any Herman Nelson Unit Blower to: HEATING AND VENTILATING PRODUCTS, DEPT. HP-7, AMERICAN AIR FILTER COMPANY, INC., LOUISVILLE 8, KENTUCKY.

. . . another product of

AAF

herman nelson

American Air Filter
COMPANY, INC.

CHECK THESE HERMAN NELSON ADVANTAGES

- ✓ Rugged, highly efficient wheel construction
- ✓ Attractive, modern streamlined appearance
- ✓ Statically and dynamically balanced wheels
- ✓ Completely self-contained units including motors
- ✓ Compact design, easily fits small spaces
- ✓ N.A.F.M. certified performance
- ✓ 103 Models—capacities 360 to 18,300 cfm

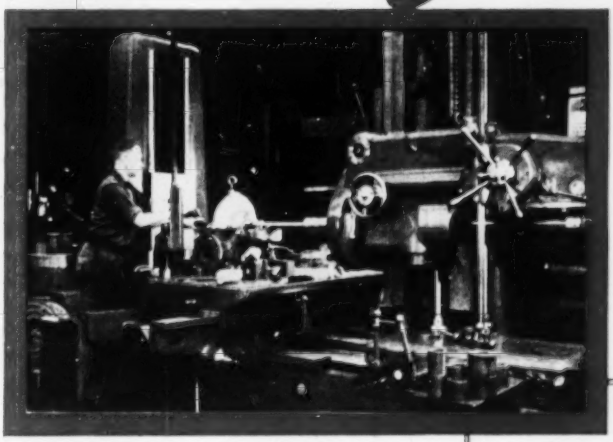
Fine Machine Work

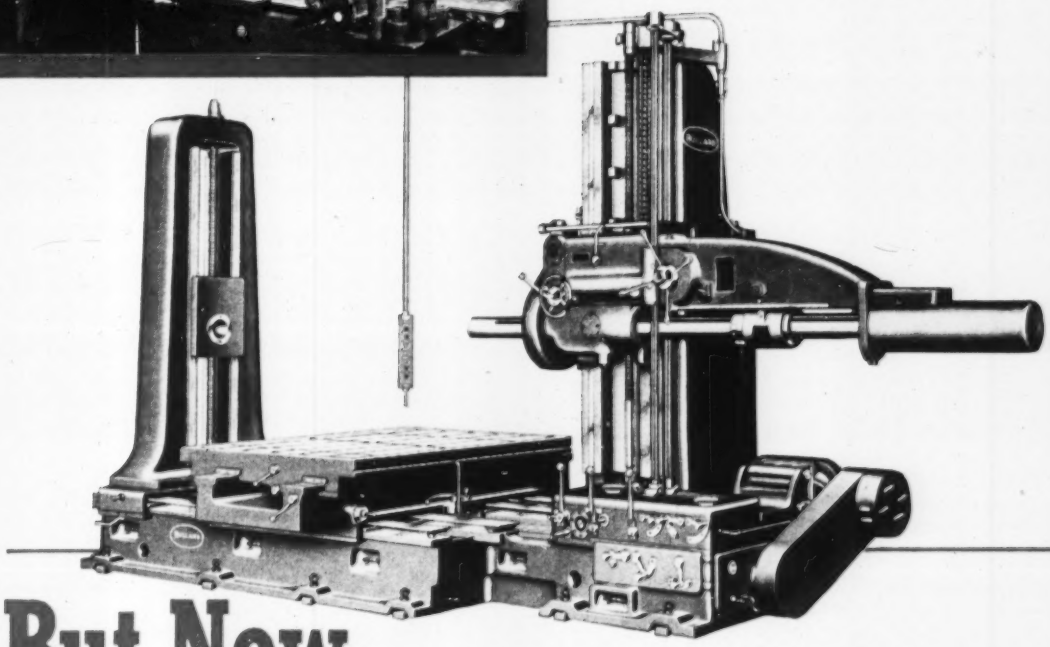
"Decides the Quality of a Pump"

. . says
Warren Steam Pump Co.
of Warren, Mass.

testimonial enough
for their five

Universal
Boring Machines



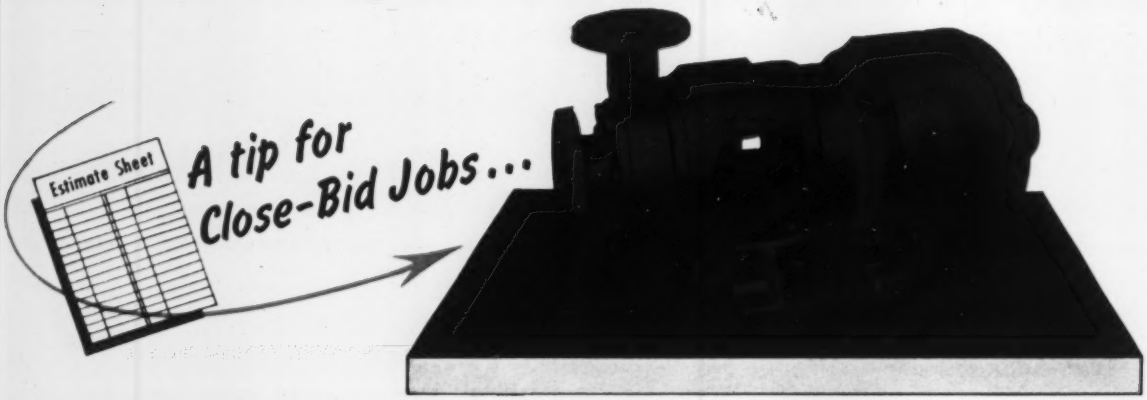


But Now... Universal Redesigned by Bullard offers a broad 4-way bed Horizontal Boring, Milling and Drilling machine with an even Higher Degree of Rigidity, Accuracy and Serviceability.

Call in a Bullard Engineer or write for complete details describing the many points of Redesign and Modernizing.

Bullardize your plant for Higher Efficiency.

THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT



I-R MOTORPUMPS PROVIDE THE MARGIN OF PROFIT

A Model RVN Motorpump circulating water on an evaporative cooler for a small office building.

When bidding is close . . . when you've shaved your costs to the bone, there's one sure way of getting the job and making a profit—*specify equipment that does more!*

Here's an example:

Next time a job requires a 2 hp pump, or a 5 hp pump or any other size, install an Ingersoll-Rand Motorpump that gives you a saving in horsepower over ordinary pumps!

Yes, use *smaller* pumps to do bigger jobs! Exhaustive tests prove that, in most cases, a smaller Ingersoll-Rand Motorpump will do the job . . . and you get this same advantage in every size of I-R Motorpump from a ¼ hp to 50 hp!

I-R Motorpumps give you a competitive advantage. It means you can figure to closer margins.

For complete details, call your nearest I-R branch office or write direct.

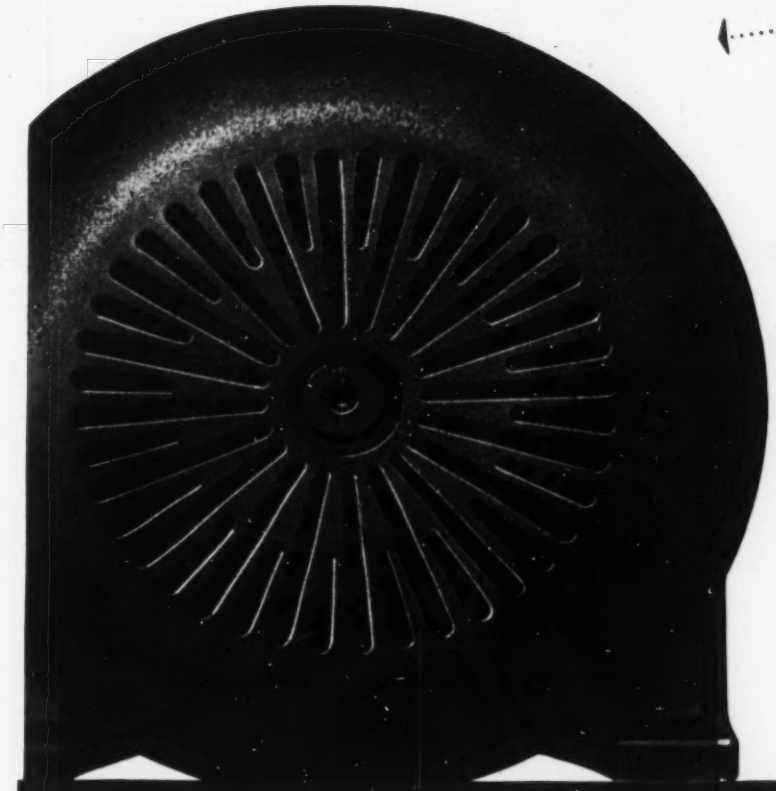
Ingersoll-Rand MOTORPUMPS for Improved Air Conditioning Operation

A WIDE RANGE OF SIZES AVAILABLE NOW FOR RUSH DELIVERY.

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. 819.9

DEPENDABILITY . . .
that builds reputation
Delco Motors



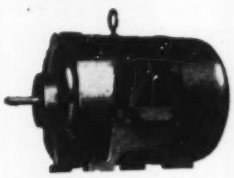
If your product needs a power source, look to Delco for the motor that will serve you best. Delco makes motors for most industrial applications . . . motors famous for dependability and long life under the toughest operating conditions.

So . . . check on Delco. You'll find a Delco motor that fits your needs. For complete details write to Delco Products, Dayton, Ohio, or to the nearest sales office listed below.

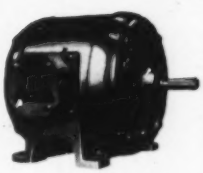
DELCO
DAYTON OHIO

DELCO PRODUCTS

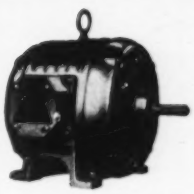
Division of General Motors Corporation
Dayton, Ohio



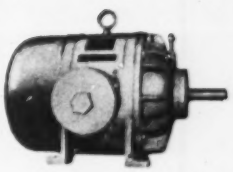
Totally Enclosed Fan-Cooled Motor



Open Ball-Bearing Motor



Totally Enclosed Motor

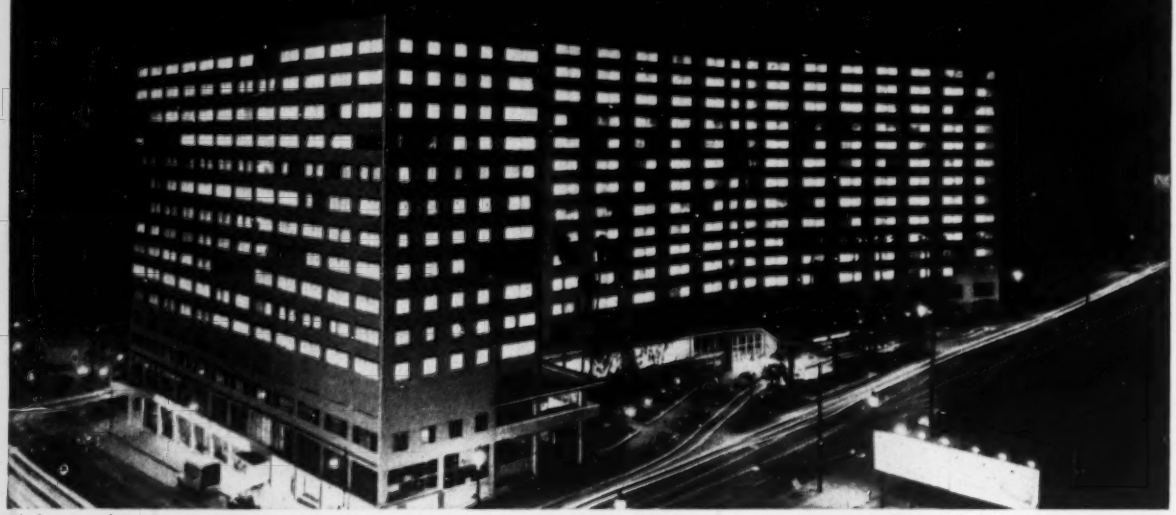


Explosion-Proof Motor

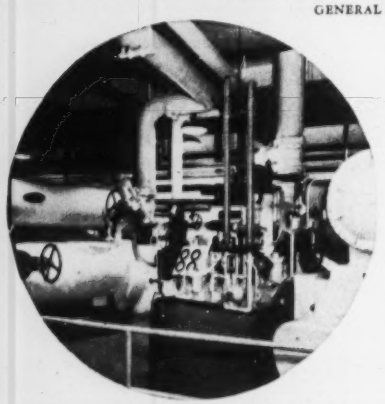
SALES OFFICES: Atlanta • Chicago • Cincinnati • Cleveland • Dallas • Detroit • Hartford • Philadelphia • St. Louis • San Francisco

everything about Statler Center says . . .

HOTEL OF THE FUTURE



Architects and Engineers: HOLABIRD & ROOT & BURGEE, CHICAGO. *Associate Architect:* WILLIAM B. TABLER, NEW YORK *General Contractor:* ROBERT E. MCKEE, GENERAL CONTRACTOR, INC., LOS ANGELES *Mechanical Contractor:* MEHRING AND HANSON COMPANY, LOS ANGELES



Among the 8000 Bronze and 700 Iron Jenkins Valves required for the piping systems which serve Statler Center are these, used at control points in the air conditioning equipment.

Boiler room in Statler Center, showing Jenkins Valves installed on hot water generators. A "City Within A City", the Center occupies an entire city block, has 120,000 sq. ft. of space.

. . . from building design to JENKINS VALVES

Here, honey-combed with light from 1300 picture windows, is Los Angeles' Statler Center — a shining example of future-minded planning. The $25,000,000 structure combines a 13-story office building with a luxurious hotel, thereby increasing use of public facilities and assuring a more stable income.

Guest rooms carry a step further the combination sleeping and conference room idea developed by Statler. Even its operating equipment marks the new Statler, as "The Hotel of the Future".

For heating, plumbing, air conditioning, sprinkler, and other vital pipelines, Jenkins Valves were selected . . . on the basis of *low upkeep cost records* in all types of services. This confidence in the demonstrated *extra measure* of efficiency and economy provided by Jenkins Valves is shared by leading architects, engineers, and contractors in every field of construction.

Despite this extra value, *you pay no more* for Jenkins Valves. For new installations, for all replacements, let the Jenkins Diamond be your guide to lasting valve economy.
Jenkins Bros., 100 Park Ave., New York 17.

JENKINS VALVES

LOOK FOR THE DIAMOND MARK

SINCE 1864 TRADE JENKINS MARK

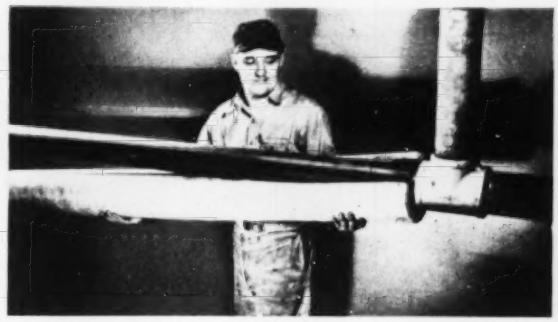
Jenkins Bros

SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS EVERYWHERE

EQUIPMENT DEVELOPMENTS...

Glass Fiber Pipe Insulation

HPAC 1—One piece molded fine glass fiber pipe insulation. . . .The glass fiber is bonded with a phenolic resin and molded into one piece sections. According to the manufacturer, the new material, "Ultrafine," is suited



for heating piping application up to 350 F, is lightweight, flexible, insoluble in water, can be cut easily and painted. It is designed so that it will not rot, mold, decay or absorb moisture. The insulation comes in 6 ft lengths. [Manufacturer: Gustin-Bacon Mfg. Co., 210 W. 10th St., Kansas City 6, Mo.]

Electrode for Mild Steel

HPAC 2—Improved E6010 electrode, the "Airco 78E," for welding mild steel in all positions. . . .According to the manufacturer, this electrode offers deep penetration without under cutting, a minimum of spatter and uniform weld deposits without fingernailing. It is designed so that the deposit hardens quickly for vertical and overhead positions. [Manufacturer: Air Reduction Sales Co., 60 E. 42nd St., New York 17.]

Electronically-Controlled Valve

HPAC 3*—An electronically-controlled valve for remote control operation constructed from special specifications by the Lunkenheimer Co. of Cincinnati, for the Continental Supply Co., was used in a joint demonstration with the Radio Corp. of America . . . . Featured during the 30th International Petroleum Exposition at Tulsa, the electronically-controlled 300 lb steel gate valve was located in the RCA booth in the Continental Bldg. next to the manufacturer's booth, on the exposition grounds. The electronic controls which operated the valve were set up in the lobby of a downtown hotel and the valve mechanism was activated by microwave. Television cameras and receivers at the hotel and at the exposition grounds

enabled observers at the hotel to watch the valve operation at the exposition grounds and observers at the exposition grounds to see the operator push the control buttons at the hotel. [Manufacturer: Lunkenheimer Co., Waverly & Beekman Sts., Cincinnati 11.]

Electronic Heating for Trains

HPAC 4—Heating control system for railway passenger cars applying electronic controls to existing steam systems . . . .Installation of the new system involves a modification of the steam system to obtain improved heat distribution and eliminate hot and cold spots. The modification is accomplished by using accurately spaced steam jets. Controls include electronic thermostats, a control panel,

For your convenience in obtaining more information about any of this equipment use this coupon. Add the new products and companies listed here to your Directory Section which you received in your January 1953 Heating, Piping & Air Conditioning, and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk, equipment and manufacturer not listed.

[7-53]

FOR YOUR CONVENIENCE

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about equipment mentioned under these reference numbers in Equipment Developments.

(Circle each HPAC number in which you are interested)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

Name _____ **Title** _____

Company _____

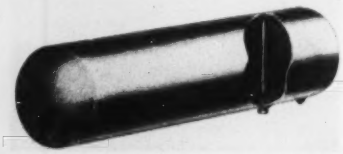
Address _____

City _____ **Zone** _____ **State** _____

modulating steam valve and a pressure reducing valve. According to the manufacturer, the engine control is a high-pressure thermostat that works directly from the air supply on the locomotive without requiring a pressure-reducing valve. The thermostat operates a single-piston to position radiator shutters. [Manufacturer: Minneapolis-Honeywell Regulator Co., 2641 4th Ave. S., Minneapolis 8.]

Vacuum Breaker for Pressure Tanks

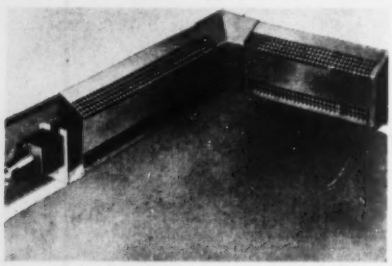
HPAC 5*—Vacuum breaker to drain pressure tanks in hot water heating systems. . . .The breaker is designed to admit air quickly and speed draining. The whole



system does not have to be drained. According to the manufacturer, the average tank will drain in 10 min. Installation of the equipment is made at the factory. [Manufacturer: H. A. Thrush & Co., Peru, Ind.]

Floor Level Baseboard Convector

HPAC 6—One of the new features of this baseboard convector is the design of the cover which, when installed, rests on the floor. . . .The new design cover has air stream outlets in front and on the slanted portion of the cover to direct the warm air away from the wall. The convector is designed for use with all types of hot water or steam



installations. A back plate is provided that rests on the floor and is secured to the studs. Element hangers snap on to the back plate. The element is placed in the hangers after assembly. Corner sections and end plates are provided. [Manufacturer: Rempe Co., 340 N. Sacramento Blvd., Chicago 12.]

Corrosion Control in Steam Systems

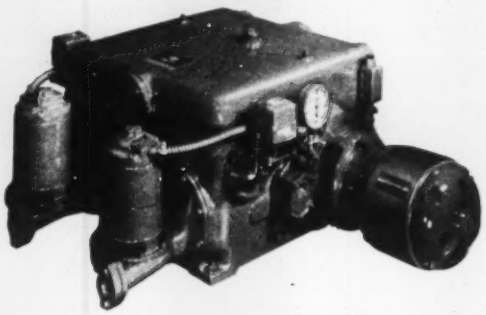
HPAC 7*—A film-forming amine, "Hagafilm," used to control corrosion in steam condensate systems resulting from the presence of oxygen and acid carbon dioxide. . . . The material is fed to the boiler in small amounts, approximately 2 or 3 lb per million lb of steam. There it vaporizes with the steam and deposits a thin, non-wettable protective film on all metal surfaces wherever condensation occurs and throughout the return system, the company states. The material is supplied in both solid and liquid form. [Manufacturer: Hagan Corp., Hagan Bldg., Pittsburgh 30, Pa.]

One-Piece Needle Valve

HPAC 8—Steel needle valve designed for working pressures up to 10,000 psi. . . .Valve bodies and valve stem guides are joined into a one-piece construction by the manufacturer's process known as "Conoweld." The company states that the fusing of the stem guide and body provides a leakproof joint and eliminates the danger of the valve stem guide becoming loose while unscrewing the valve stem. Deep chamfered threads, machined to extra long length, are said to permit under-sized pipe threads to make up tightly. [Manufacturer: Marsh Instrument Co., Skokie, Ill.]

Vacuum Heating Pump

HPAC 9—New design features in the "CSM" vacuum heating pump. . . .In the new model, air pumping and water pumping units are separate, each with its own motor and control. Each pump operates only when needed. Capacities of the individual pumping units may be varied



so that the air and water capacities of the pump are not based upon sq ft of equivalent direct radiation. The manufacturer states that capacity may be increased to accommodate additional radiation without changing basic pump installation. [Manufacturer: Nash Engineering Co., 436 Wilson Ave., South Norwalk, Conn.]

Sequence Valve

HPAC 10**—Improved valve permits single control of multi-operations. . . .According to the manufacturer, it makes possible the operation of two or more cylinders in their correct sequence without manual handling. The company also states that a high degree of sensitivity allows positive operation at pressures from 20 to 200 lb psi air, oil or water. It is available in six standard pipe sizes from ¼ to 1-¼ in. [Manufacturer: Airmatic Valve, Inc., 7317 Associate Ave., Cleveland 9.]

Regulator

Valve

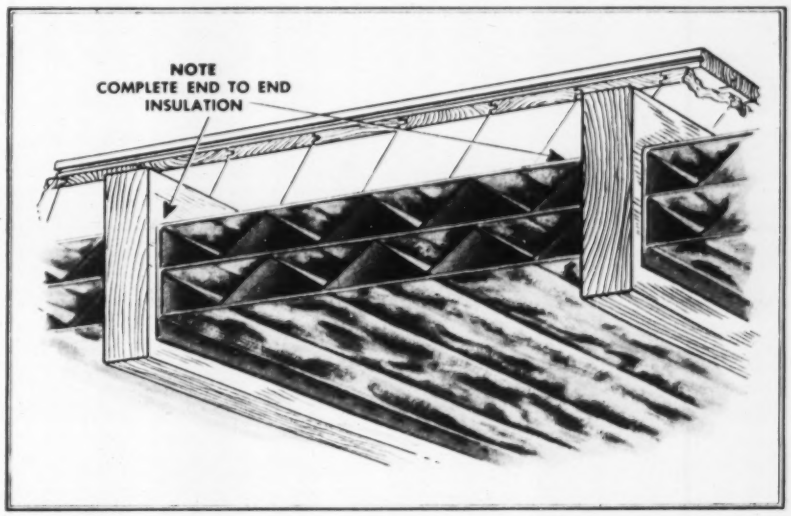
Compressed Air Regulator

HPAC 11—Air regulator designed to handle a large volume of compressed air with a minimum of pressure drop

NEWEST INSULATION FULLY INSULATES FROM END TO END

Gives Every Fraction of an Inch Between Joists or Studs Maximum Protection Against Heat Loss and Condensation Formation.

CLOSELY hugging for its entire depth the studs or joists to which its flanges are stapled, a new, improved form of aluminum insulation gives complete insulation coverage over the entire surface area it shields. The protection afforded by multiple sheets of accordion aluminum against condensation formation and heat-flow is increased at the ends.



Like its predecessor, this new form of multiple accordion aluminum is prefabricated to create automatically a "blanket" of alternating layers of air, aluminum and fiber partitions as it is installed. But this "blanket" is now of **uniform** depth. It has high reflectivity and low absorptivity of heat rays; low conduction because of preponderant air spaces and insignificant mass. Its compartmented layers retard convection. Because of its slight mass there is little heat storage. It is virtually non-condensation-forming. A detailed discussion of "how aluminum insulates—and why," will be found in "Thermal Test Coefficients of Aluminum Insulation for Buildings," published by the American Society of Heating and Ventilating Engineers. A free copy and samples of the new insulation on request.

The new type of "complete coverage" multiple accordion aluminum is being made the standard Infra Insulation, Types 6-S_i, 4-S_i. Large scale production and mechanical innovations bring costs to a low figure.

COST OF INFRA INSULATION INSTALLED
in new construction between wood joists, material with labor,

Type 6-S_i under 9½¢ sq. ft.
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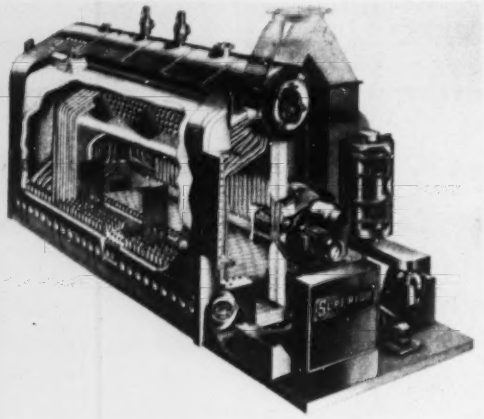
. . . The "HAA" regulator has a capacity of 80 cfm at 100 lb line pressure. According to the manufacturer, more sensitive control and reduced pressure losses have been achieved by using air pressure against the regulating diaphragm instead of the spring-loaded diaphragm to provide power regulation. Air flow increases as demand increases without affecting the pressure which has been set. The maximum pressure which can be regulated is 135 psi and maximum line pressure is 300 psi, the company states. [Manufacturer: The DeVilbiss Co., 300 Phillips Ave., Toledo 1, Ohio.]

Water-Tube Steam Generator

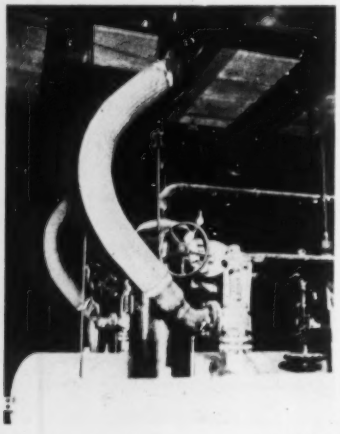
HPAC 12—Packaged water-tube steam generator designed to provide automatic firing with oil, gas or stoker coal. . . . Refractory, insulation, burner, controls, interconnecting piping and wiring are installed at the factory.



Units can be furnished for permanent outdoor installation. "A" type design promotes quick steaming and the tube layout protects the steam drum from direct impingement. [Manufacturer: Superior Combustion Industries, Inc., Room 305, 1175 Broadway, New York, N. Y.]

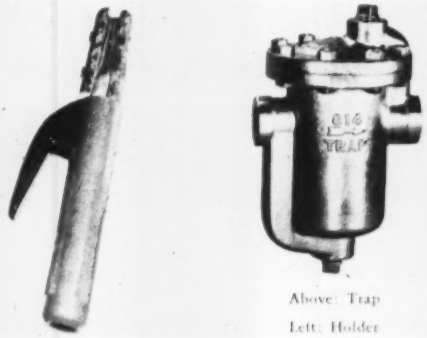
Flexible Metal Hose for Valve Safety Exhaust

HPAC 13—A new corrugated, flexible metal hose assembly designed to eliminate the noise caused by the unexpected discharging of safety valves. . . . The flexible assembly is attached to the safety valve and extends to the exhaust pipe. When the valve blows, the sealed unit absorbs sound, heat and vibration. [Manufacturer: Flexonics Corp., 1391 S. Third Ave., Maywood, Ill.]



Electrode Holder

HPAC 14*—Electrode holder for arc welding designed to be cooler and lighter. . . . The company states there is less tendency for the holder to roll in the operator's hand because the jaw lever is placed close to the handle. A squeeze of the hand releases the electrode stub. A fully enclosed spring and patented spring adjustment is said to insure longer production duty. Reversible jaw insulators can be reconditioned on the line. [Manufacturer: A. O. Smith Corp., Welding Products Div., Box 584, Milwaukee.]



Above: Trap
Left: Holder

Steam Trap

HPAC 15—The "No. 814," a side inlet-side outlet steam trap with horizontal and opposite pipe connections. . . . Threaded connections are 1 or 1¼ in. Capacities range up to 6300 lb per hr, depending on the pressure. Pressure range is 0 to 250 psi. Height is 13-5/8 in., diameter is 9 in. [Manufacturer: Armstrong Machine Works, 871 Maple St., Three Rivers, Mich.]

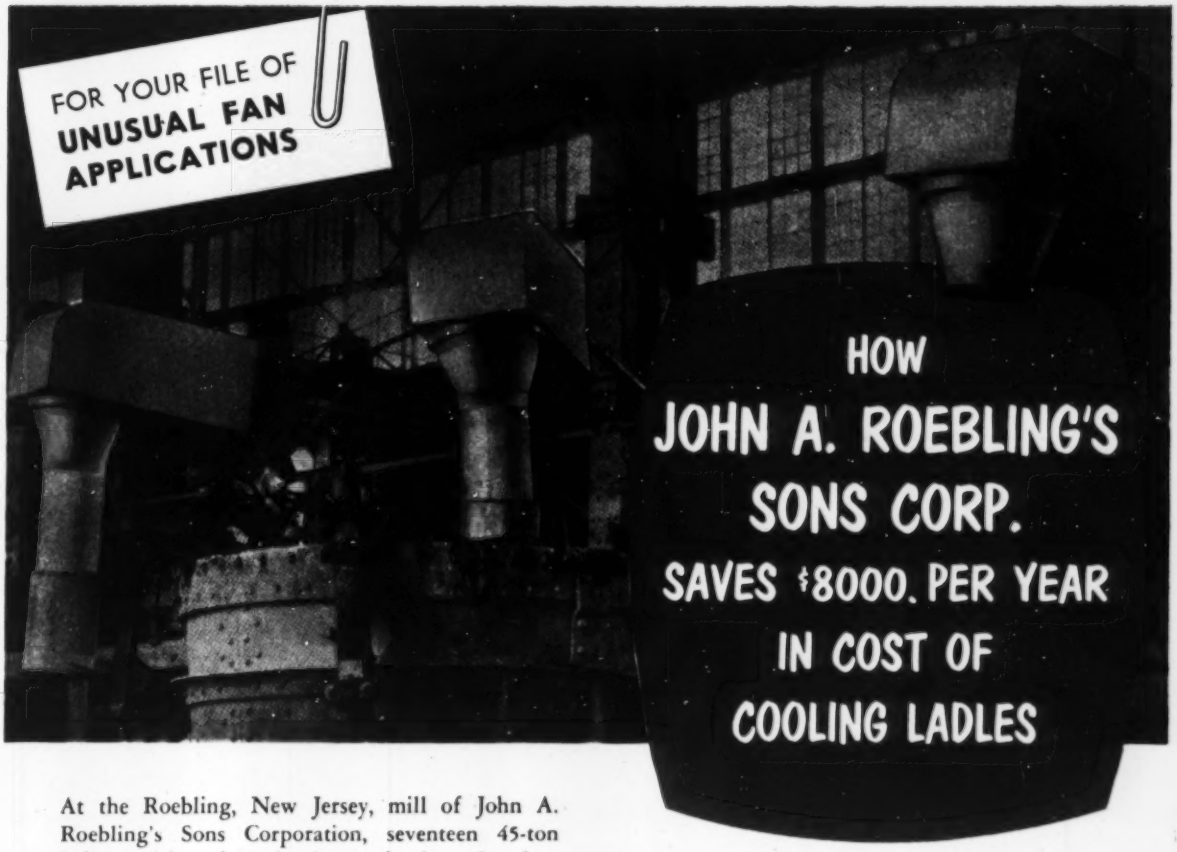
Labels for Pipe Identification

HPAC 16*—Pipe identification system uses custom-made labels of Vinylite plastic rigid sheet. . . . The rolled label is spread by hand and allowed to spring closed around the pipe. It is colored and worded to fit exact requirements. Corrosive conditions, temperature and humidity changes have little effect on the Vinylite. The labels are available in 6, 8, 10 and 12 in. in length to fit any size pipe up to 30 in. in diameter. [Manufacturer: Wilmington Plastics, Inc., 810 S. Heald St., Wilmington, Del.]

Redesigned Valves

HPAC 17—Redesigned line of 600 lb small steel globe, angle and check valves. . . . Two new features include

[Continued on page 213]



FOR YOUR FILE OF
UNUSUAL FAN APPLICATIONS

HOW JOHN A. ROEBLING'S SONS CORP. SAVES $8000. PER YEAR IN COST OF COOLING LADLES

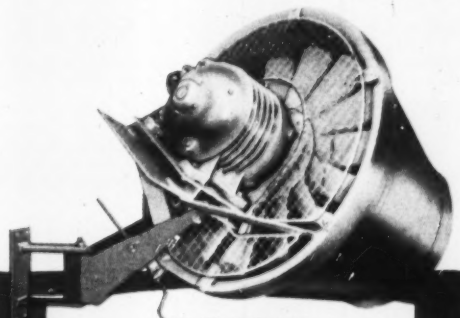
At the Roebling, New Jersey, mill of John A. Roebling's Sons Corporation, seventeen 45-ton ladles are kept busy in the production of carbon steel, from which the famous Roebling wire rope is made. After each heat, ladles must be cooled down from 2000° F and pouring nozzles installed.

Dissatisfied with the old method of using compressed air for cooling ladles, engineers at Roebling's conceived the idea of trying a DeBothezat "Hy-V" Air Jet to do the job. They selected a "Hy-V" Air Jet with 21" fan wheel and 1½ HP motor which produces 5600 CFM at a nozzle velocity of 4570 FPM, and it worked so well that Roebling has installed four more. Each is mounted on a swinging bracket and is equipped with special nozzle extension so that air is discharged near the bottom of the ladle. Nozzle extension is retractable.

Here's what E. M. Yard, Roebling Combustion Engineer, has to say about the installation: *"Nearly the full capacity of one 200 HP air compressor was previously used to do this job. The use of "Hy-V" Air Jets means a power saving of probably $8,000.00 per year. In addition, the installation of these fan units, at a total cost of about $4,000.00 eliminated the need for additional air compressor capacity which would have cost $16,000.00. These fan units will recover their cost in about six months from power savings alone."*

Whether it's a question of cooling people or equipment, "Hy-V" Air Jets do the job efficiently and inexpensively. For detailed information, ask your DeBothezat representative or write our factory, Dept HP753, for catalog DH-8-51.

Certified Ratings
AMA



"HY-V" AIR JET
is a 14-blade axial-flow pressure fan which projects a high velocity stream of air as far as 65 feet. Built with fan wheels 18" through 30" in diameter, with nozzle velocities up to 5780 FPM.

DeBothezat Fans

Division of American Machine and Metals, Inc.
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Announces

A NEW FACTUAL METHOD OF SIZING CONTROL VALVES FOR FLASHING CONDENSATE SERVICE

This new simplified valve sizing procedure is based on over 7,000 man hours of actual laboratory test data utilizing modern testing and measuring methods.

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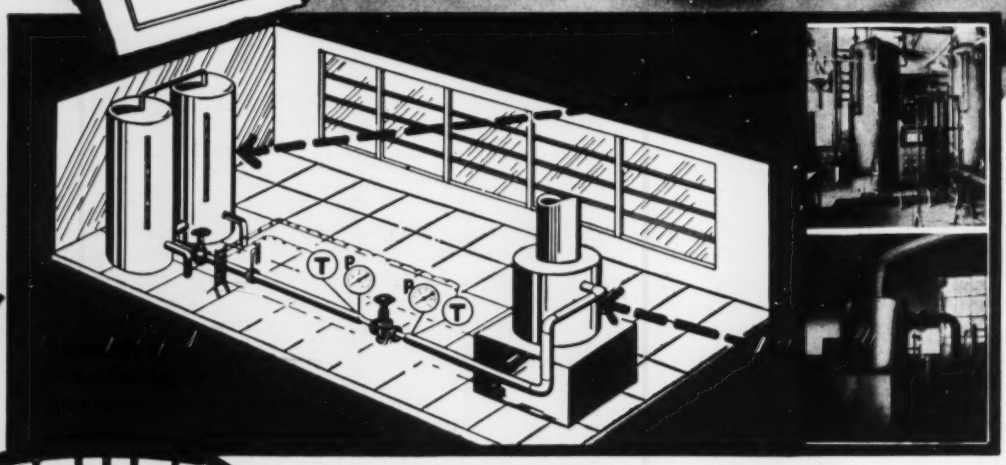

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WORLD LEADER IN RESEARCH FOR BETTER PRESSURE AND LIQUID LEVEL CONTROL

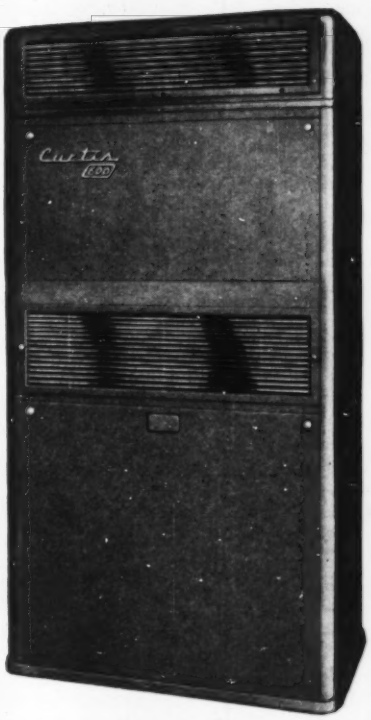
YOU PROFIT BY

Curtis EXPERIENCE

in 15 years

of Packaged Air Conditioning Pioneering

One of the First in the Industry



Curtis units that were installed back in the days when packaged air conditioning was a novelty are still giving faultless service. Today's Curtis packaged units are better than ever . . . perfected by 15 years of experience.

YOU'LL SELL more packaged units when you sell these Curtis advantages:

- Long life, slow speed operation
- Quiet and dependable
- 5 year warranty
- Easy installation
- Attractive, modern appearance
- Complete range of sizes — 2, 3, 5, 7½, 10 and 15 tons

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of Curtis Manufacturing Company (Since 1854)
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Company Name.....

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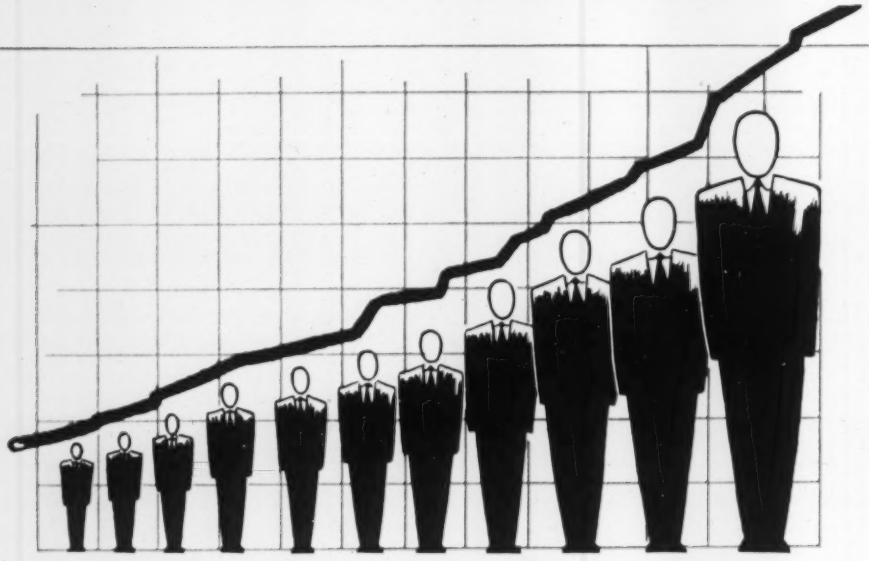
City..... Zone..... State.....

Signed.....

with more and more homeowners turning to **YEAR 'ROUND CONDITIONING...**



Authoritative forecasts indicate home air conditioning will grow to a 5-billion-dollar business by 1958!

You can double your profit with bryant

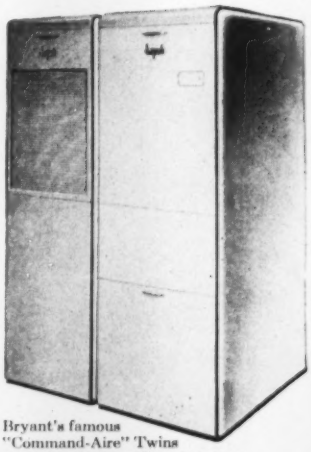
Take your choice!

First—in Bryant's "Command-Aire" Twins you can sell, at one time, both heating and cooling . . . realizing an immediate double or even greater profit. And, the surprisingly low unit price promises large volume sales—a plus factor for even greater profits. Or . . .

Second—you can sell heating first—air conditioning later! With the "Command-Aire" Twins, you have the opportunity to sell the furnace first (either gas or oil) and then arrange to add the air-conditioning twin at the convenience of the buyer. No matter how you figure it you're in the ideal position to conclude a highly profitable double sale.

And Bryant helps you sell! To strongly supplement Bryant's extensive national advertising program, Bryant heating and air-conditioning literature will be sent to over 80,000 families definitely known to be building new homes within the next 12 months. Names of these families, in your area, will be supplied to you—another reason to investigate this handsome 2-way profit opportunity, today.

Contact your nearby Bryant distributor for complete information, or simply write: Bryant Heater Division, 17825 St. Clair Avenue, Cleveland 10, Ohio.

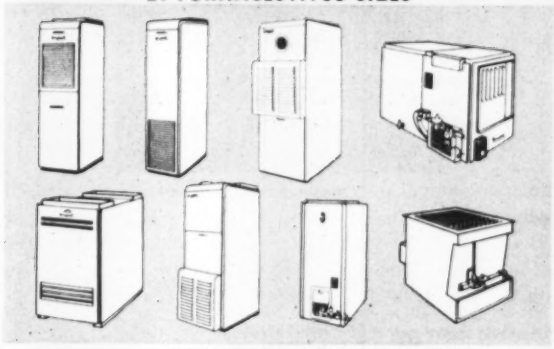


Bryant's famous "Command-Aire" Twins year 'round air-conditioning team.

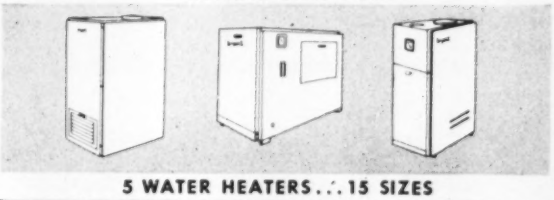
Profit with the name that everybody knows...

THE MOST COMPLETE LINE OF HOME CONDITIONING EQUIPMENT IN THE INDUSTRY

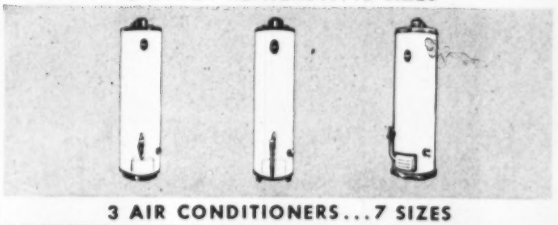
21 FURNACES... 83 SIZES



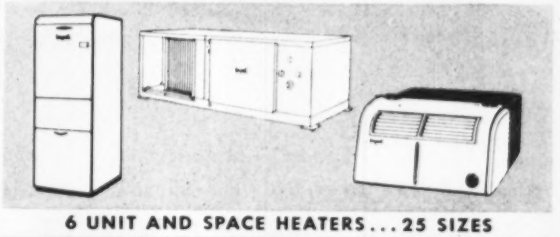
4 BOILERS... 45 SIZES



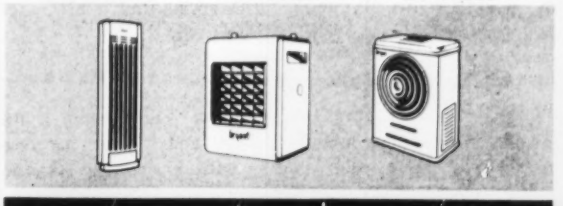
5 WATER HEATERS... 15 SIZES



3 AIR CONDITIONERS... 7 SIZES



6 UNIT AND SPACE HEATERS... 25 SIZES



bryant®

HEATING • AIR CONDITIONING WATER HEATING

[*Continued from page 208*]

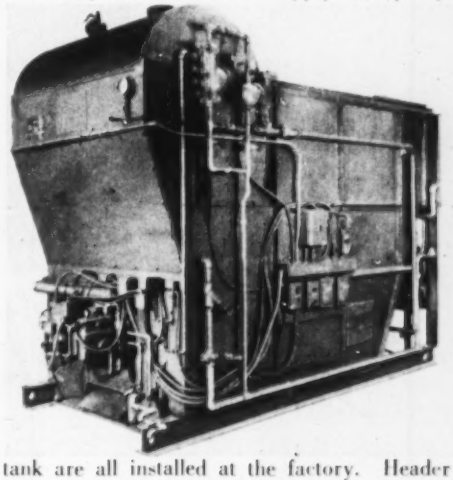
a "full-way" plug type disc with increased seating width and a new chromium stainless steel seat which eliminates conventional seat rings. The introduction of the plug type disc enables the company to discontinue the throttling type seat and disc valves. The new disc is made of Type 420 chromium stainless steel and has a 500 Brinell hardness. The "lay-on" seat has a 350 Brinell hardness. [Manufacturer: The Lunkenheimer Co., Waverly and Beekman Sts., Cincinnati, Ohio.]

Air Flow Regulator

HPAC 18**—Regulation of air flow in heating and air conditioning system by use of a spring-loaded knob . . . . An indicator on the knob shows the position of the damper in the duct. Adjustment is made by pressing the knob and turning. When it is released, the knob locks in position. Flow of air can be adjusted in about half the time formerly required, the company states. [Manufacturer: Wa-Trol Co., P.O. Box 6366, Houston.]

Packaged Steam Boiler

HPAC 19—"Cross-Drum" steam boiler in the 100-200 hp range for locations where overhead clearance is low . . . . Packaged unit is designed to take up less headroom because of a compact cross drum design. Firebox, precast refractory walls and water supply with pump, motor



and tank are all installed at the factory. Header plates allow access to the tubes for cleaning. According to the company, the boiler is able to withstand long periods of overload. [Manufacturer: Mund Boilers, Inc., 1600 N. Indiana St., Los Angeles 63.]

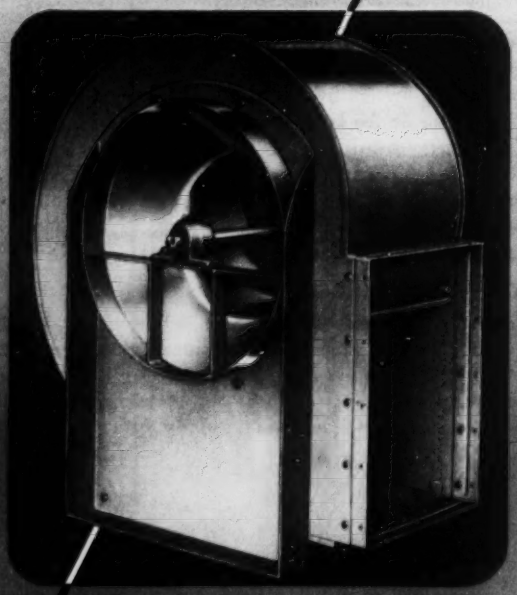
Small Cooling Tower

HPAC 20—Newest addition to company's line of heat transfer equipment is a small cooling tower for residential, commercial and industrial air conditioning systems. . . .Known as the "Thrifti-Tower," it is designed to save up to 95 per cent of normal water demand. It ranges in capacity from 2 to 16 tons. It incorporates the "Lektro-Tektor" protection against electrolytic corrosion of the sump tank. The tower is adaptable for indoor or outdoor installation. [Manufacturer: Marlo Coil Co., 6135 Manchester Ave., St. Louis 10.]

Bronze Impeller Pump for Oils and Greases

HPAC 21*—Bronze impeller, positive displacement pump for handling oils and greases. . . .The positive

ALADDIN
FANS



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CERTIFIED RATINGS
Certified ratings are the result of tests made by the manufacturer in accordance with the Standard Test Code for Fans adopted by the National Association of Fan Manufacturers, Inc. and approved by the American Standards Association.
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● RUGGED
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You will find that ALADDIN Fans are available in many types . . . each ruggedly built and fully equal to the job for which it is intended. Thousands of ALADDIN Fans are now in service meeting the air-handling requirements of every essential industry, from chemical to aircraft, on farms and aboard ships.

More and more architects and engineers have come to know ALADDIN Fans . . . and to recognize their merits of quality and dependability.

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REPRESENTATIVES IN ALL PRINCIPAL CITIES IN THE WEST

displacement delivery is the result of two axially oscillating impellers which deliver a non-surging flow without foaming or air entrainment. According to the company, the sintered bronze powder-metal impellers are designed to act like oiless bearings operating in a lubricating me-

dium absorbing and retaining oils. The pumps are self-priming in low temperatures and are said to be suitable for operating oil temperatures up to 500 F. They may be operated submerged. [Manufacturer: Eco Engineering Co., Newark, N.J.]

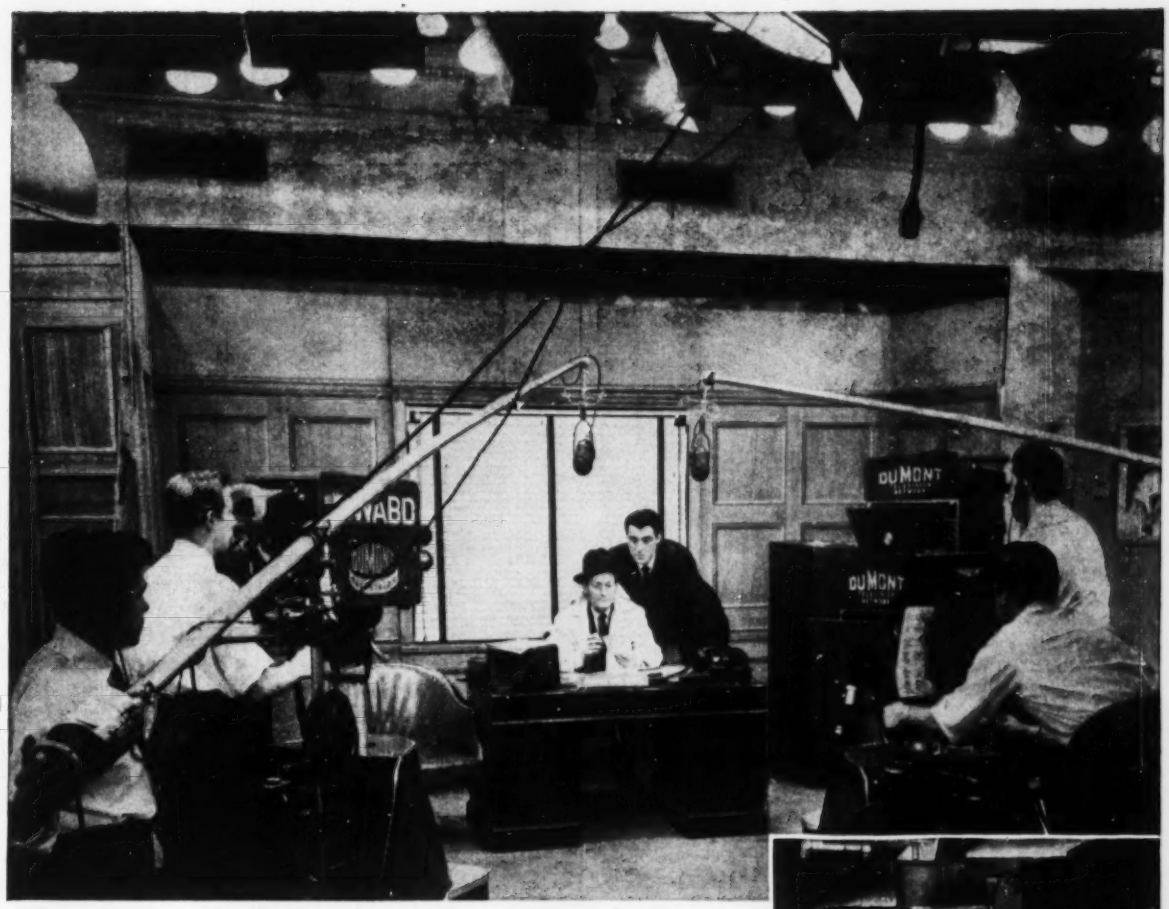
Central Station Air Conditioner

HPAC 22—Addition of "Seasonmaster" central station air conditioner now makes the company's line complete. . . .A horizontal unit is equipped with a water coil, steam coil, face and bypass, and flat filter section. The

vertical unit has a direct expansion coil, steam coil, face and bypass, and flat filter section. All coils are removable for cleaning and servicing. [Manufacturer: McQuay, Inc., 1600 Broadway, N.E., Minneapolis 13.]

Test for Solids in Boiler Water

HPAC 23—New test for solids in boiler water comparable to the conductometric method. Test involves mixing the boiler water sample with a strongly alkaline anion exchange resin, and titrating a portion of the resulting solution with acid to the proper endpoint. A milliequivalent of hydroxide is formed for every milliequivalent of salt in the sample. The volume of standard acid required for the titration, multiplied by a suitable factor, gives an accurate measure of the dissolved solids in the sample. The test was developed by the Hall Laboratories, Inc., of Pittsburgh. Further information is available from the Hagan Corp., P.O. Box 1346, Pittsburgh 30.



Putting Air to work for DuMont: Air conditioning must absorb the heat of powerful overhead lights. But it must be *quiet.*

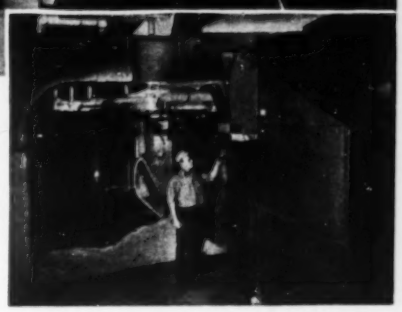
ON THE AIR

EQUIPMENT NOISE IS NOT IN THE SCRIPT

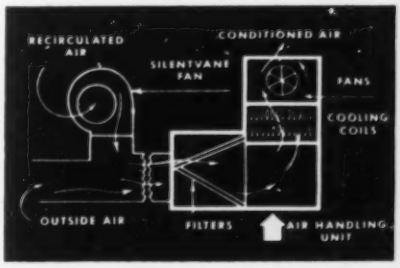
Television won't tolerate noisy equipment. Super-sensitive mikes pick up and magnify every whisper. They have to because they must keep out of camera range—often 5 to 10 feet from the actor's lips. Equipment which raises the general sound level cannot be used.

Yet these closed-in studios with their high heat loads must be air conditioned. That's why silent Westinghouse fans and air handling units were chosen for the DuMont Network's New York Tele-Centre. *Every minute* 160,000 cubic feet of conditioned air is supplied noiselessly.

If you are interested in quietness—or efficiency, or dependability—when it comes to *putting air to work*, come to Westinghouse. A complete line of air handling, air conditioning and air cleaning products means undivided responsibility. Ask us for General Catalog 600. Call your local office, or write: Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.



Here's the equipment which conditions the air. At left, one of many silent Westinghouse fans pulls heat-laden air from the station. At right, one of the "packaged" Westinghouse air handling units filters the air, cools, dehumidifies, and returns it. These factory-assembled units give quiet, dependable performance—with a single manufacturer's warranty.



WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE ... IF IT'S **Westinghouse**

Original installation or extension of existing heating plants—

Ray Service is always handy!

Wherever you are, whatever type of burner your specifications call for...a capable Ray Franchised Dealer is at your service to help you plan and to complete your burner installation.

Ray dealers are part of a team which has been growing in size and efficiency for 81 years. Modern facilities and techniques combine with experience to provide the best oil burner service you can buy. That is why today *"Every third rotary oil burner in service is a Ray"*.

Contact the Ray Dealer nearest you and take advantage of this complete engineering and installation service.

***Rely on your Ray Dealer*—you'll find his name in the yellow pages of your telephone directory.**

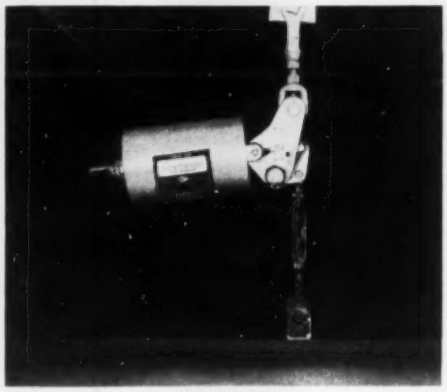
There is a Ray Burner for every purpose from 3 to 1,000 H. P. firing oil, gas, or gas-oil combination.

RAY OIL BURNER CO.

1301 San Jose Avenue • San Francisco 12, California
Atlantic Seaboard Div. • 629 Grove St., Jersey City 2, N.J.

Pipe Hanger

HPAC 24—"Counterpoise" pipe hanger for support of high temperature piping systems . . . . It is a spring-actuated counterbalance which, through a system of linkage, is designed to transform the varying force of the



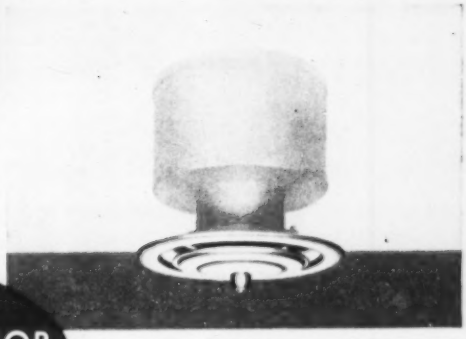
spring in a mathematical ratio to produce a load supporting effort of constant value throughout the range of travel as the pipe expands or contracts due to temperature changes. The hanger is also designed so that all principal load-carrying parts are concentrated at one end. It is available in 16 frame sizes with load capacity ranging from 200 to 16,000 lb and expansion travels up to 12 in. [Manufacturer: National Valve & Mfg. Co., 3131 Liberty Ave., Pittsburgh 1, Pa.]

Packaged Air Conditioner

HPAC 25—New addition to firm's "Mayfair" line is a packaged air conditioner for commercial establishments . . . .It is built around a hermetically sealed refrigerant circuit which is internally spring mounted. It consists of a gas cooled compressor and a counterflow condenser with removable header plates. A high pressure cutout is de-

signed to offer protection against abnormal condensing pressures. Controls include an adjustable thermostat, a three-way switch and a humidity control. Air direction and flow are controlled by a four-way adjustable grille in the plenum section on top of the unit. Winter heating can be provided by the addition of a heating coil. [Manufacturer: American Radiator & Standard Sanitary Corp., P.O. Box 1226, Pittsburgh 30, Pa.]

AIR CONDITIONING SYSTEM for Hutzler's Towson has a total capacity of 500 tons of refrigeration, with an air supply of 100,000 cu. ft. per minute. Air enters the Kno-Draft Diffuser through a perforated cylinder that induces a pressure drop. A simple adjustment screw in the center plate of the diffuser readily positions the piston in the damper—controlling the number of perforations through which the air must pass, thereby regulating the volume discharged. System engineered by Henry Adams, Inc., Baltimore; installed by Carrier Corp., Philadelphia, Pa.



● Department store air conditioning calls for extreme flexibility. Shifts in store layout are frequent and unpredictable, and the air diffusers, wherever located, must be readily adaptable to needed air changes. So—

For Hutzler's Towson, a branch store of Hutzler Brothers Co., Baltimore, a special Kno-Draft High Pressure Air Diffuser was developed. This permits the air to be distributed through small uniform-size pipelike ducts at high pressures and velocities, and diffused through conventional flush-mounted diffusers installed in a hung ceiling.

These special Kno-Draft High Pressure Air Diffusers permit air supply in any given area to be changed without unbalancing the air delivery of the other outlets. The air, in effect, is "metered." And this is done without creating any objectionable noise, and for a cost comparable to a conventional system of the same capacity.

For a more detailed description of this unique method of high pressure air distribution, simply mail us the coupon. Connor Engineering Corporation, Danbury, Connecticut.

CONNOR

kno·draft®

adjustable air diffusers

see our catalog in ARCHITECTURAL FILE or write for copy

CONNOR ENGINEERING CORPORATION
Dept. G-73, Danbury, Connecticut

Please send, without obligation, your bulletin describing the NEW Kno-Draft Adjustable Air Diffuser for high pressure air distribution.

Name .....

Position .....

Company .....

Address .....

On again!

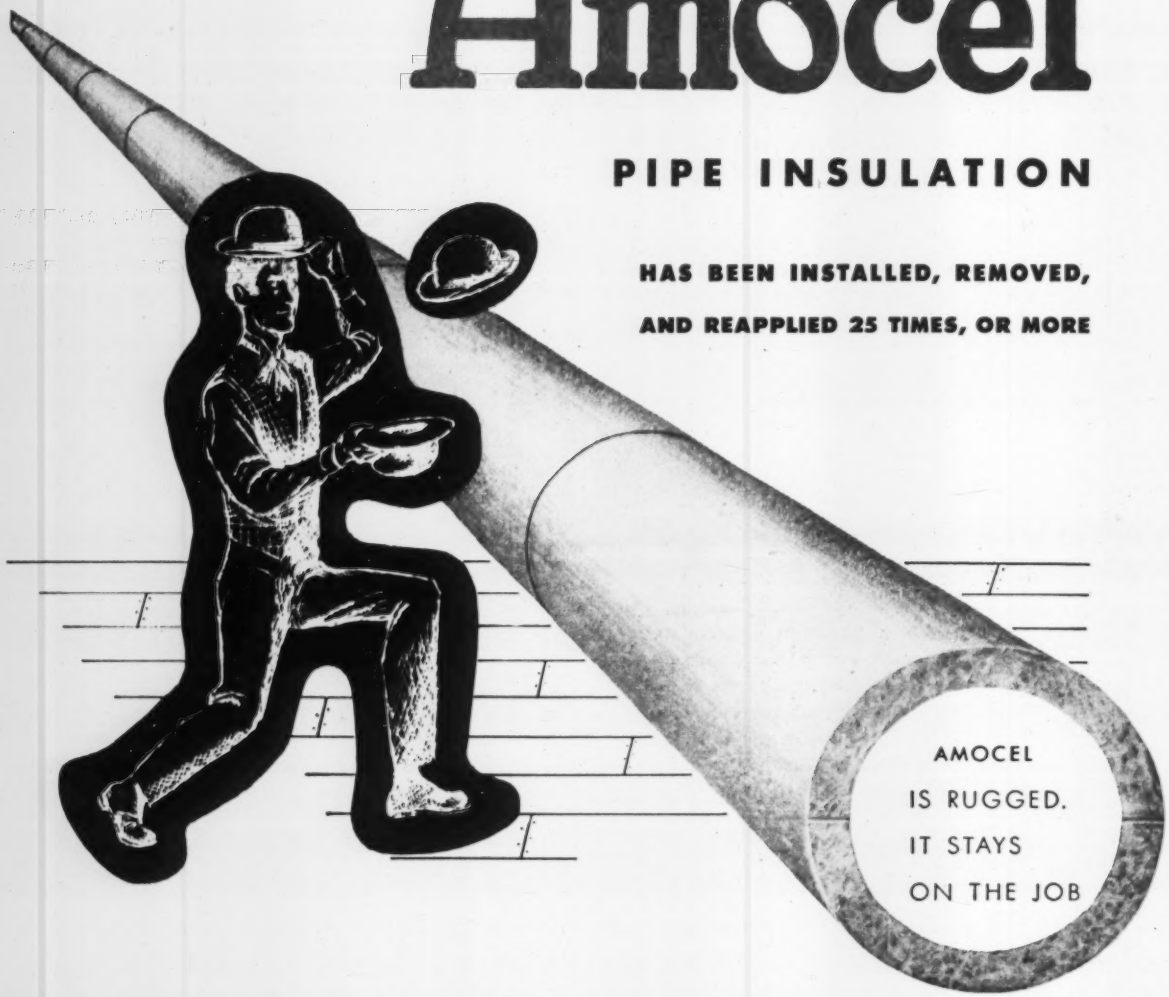
Off again!

Amocel®

PIPE INSULATION

HAS BEEN INSTALLED, REMOVED,

AND REAPPLIED 25 TIMES, OR MORE



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INDUSTRIAL Insulations

PRODUCTS OF

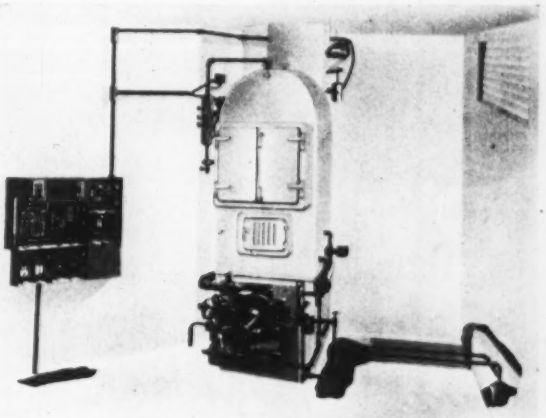
UNION ASBESTOS & RUBBER COMPANY

Electric Welded Steel Tube

HPAC 26—New use for company's electric welded steel tube. . . .The firm has developed a tube for use in low-pressure non-corrosive wet heat lines, which when used with malleable iron fittings and valves, is sweated into a joint. The method does not require any additional tools than those normally used in joining copper tube and fittings. Sizes range from ⅛ in. nominal through 2 in. nominal and will be sold by heating wholesalers throughout the country. [Manufacturer: Wolverine Tube Div. of Calumet & Hecla, Inc., 1850 Guardian Bldg., Detroit 26.]

Coordinated Fuel Burning System

HPAC 27—Factory-coordinated industrial fuel burning system is a packaged system for the conversion of large boilers to oil or gas firing . . . . Built around the "York-Power" burner for oil or gas firing, the "F/C" system includes proper controls mounted in panels and wired to



terminal strips, factory engineered windbox assembly and refractory ring, fuel oil heaters and trim. The company states that instead of selling just a rotary oil burner or a combined gas and oil burner, they are building the system complete at the plant to provide better results for the owner and installer. New literature is available on the system. [Manufacturer: Industrial Div. of York-Shipley, Inc., York, Pa.]

Safety Float Switch

HPAC 28—Safety float switch for use with automatic defrosting of "Recold" water defrost coils now is a regular stock unit. . . .The switch is designed to prevent overflow of the drain pan if the drain pipe becomes clogged. The complete assembly includes a mercury type float switch with a junction box mounted on the back, a bracket for attaching to the defrost pan and the float ball. Installation is accomplished by clamping the bracket onto the defrost pan and wiring through the solenoid water valve circuit. [Manufacturer: Refrigeration Engineering, Inc., 7250 E. Slauson Ave., Los Angeles 22.]

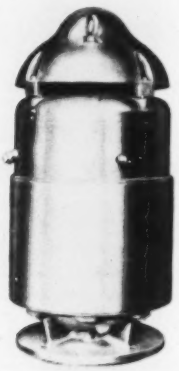
Leak Detector

HPAC 29—Halogen-sensitive leak detector redesigned to permit easier detection of leaks in closed systems . . . . In the redesigned equipment Type H-1, a loudspeaker has been built into the control unit for audible indication of leaks. Another new feature is an automatic balancing cir-

cuit to compensate for changes in background air contamination. Also incorporated in the control is a lightweight internal voltage stabilizer. [Manufacturer: General Electric Co., Schenectady 5, N. Y.]

Turbine Pump Motor

HPAC 30—Horsepower ratings of totally-enclosed and explosion proof vertical pump motors have been increased to 75 hp. . . .Available with either hollow shaft or solid shaft construction, these motors are designed for powering turbine pumps in refineries, sewage disposal plants, dangerous, dusty or dirty locations. The motors are



designed to comply with Underwriters' specifications for highly inflammable gases and volatile liquids and for combustible dusts. [Manufacturer: U.S. Electrical Motors Inc., Box 2058, Terminal Annex, Los Angeles 54.]

Threads 4 sizes of pipe *fast* with 1 set of dies— *and it won't jam!*

RIDGID

65R PIPE THREADER

This popular 65R has saved millions of hours of threading time, and no wonder—its one set of self-contained high-speed dies adjust to 1", 1¼", 1½" or 2" pipe size in 10 seconds! Mistake-proof self-centering workholder sets instantly! And lead screw won't jam on workholder, kicks out automatically at standard thread length! You can't match it for fast easy pipe threading—buy it at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIDGID
Work-Saver Pipe Tools

NOW is the time to consider

SNOW MELTING

Systems around Buildings and Grounds

Better send at once for our SNOW MELTING MANUAL. Here are design data based on a study of—and others' actual experience with over 100 snow melting systems of all kinds for

- **LOADING PLATFORMS and DOCKS**
- **SIDEWALKS • ROADS • DRIVEWAYS**
- **MARQUEES • PARKING AREAS**
- **RUNWAYS • RAILWAY SWITCHES**

and other applications which HAVE proved that this modern method of snow removal

Costs No More Than Other Methods

—and because snow melting by pipe coils has other distinct advantages, such as dirt-free sidewalks and entrances, and the complete elimination of ice surfaces, the demand for this method of snow removal is swiftly growing.

Complete information on the correct design, installation and operation of snow melting systems is offered in the new SNOW MELTING MANUAL, a reprint of articles originally published in HEATING, PIPING & AIR CONDITIONING.

$1.00 will bring you this SNOW MELTING MANUAL . . . a valuable addition to your file on business opportunities.

Heating, Piping & Air Conditioning

6 North Michigan Avenue **Chicago 2, Illinois**

WeldELLS®

...have set their own standards

Many of the largest users of Welding fittings refuse to accept any other fittings than WeldELLS.

They have found that when the name, WeldELL, is stamped into a fitting, that fitting can be accepted without question for any service for which it is designed.

They have found that WeldELLS have features that please both the men who design and the men who erect welded piping . . . features that were pioneered by Taylor Forge . . . features that are combined in no other welding fittings.

They have found the answer to their every need in the greater range of sizes, weights and types of the WeldELL line . . . in the broader scope of materials.

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see your Taylor Forge Distributor

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TAYLOR FORGE & PIPE WORKS, General Offices and Works: P.O. Box 485, Chicago 90, Ill.
Offices in all principal cities. Plants at: Carnegie, Pa.; Fontana, Calif.; Hamilton, Ont., Canada

RECENT TRADE LITERATURE

For your convenience in obtaining copies of these bulletins, see coupon on this page. If you write direct to the manufacturer, describe fully what you want, as the number given first in each item is for use only when sending requests to Heating, Piping & Air Conditioning.

FOR YOUR CONVENIENCE [7-53]

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me the publications mentioned under these reference numbers in Recent Trade Literature:

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101 102 103 104 105 106 107 108 109 110 111 112 113
114 115 116 117 119 120 121 122 125 126
127

Name ..... Title .....

Company .....

Address .....

City ..... Zone ..... State .....

Air Conditioner Selection Chart

HPAC 101—This room air conditioner selection chart has been designed to simplify selection of the proper size air conditioner required for different size rooms under various conditions. Factors that have been incorporated are map location, direction exposure, day or night operation, ceiling heights, floor area in sq ft, amount of windows or insulation and placement of rooms. [Published by: Quiet Kool Div. of Quiet Heet Mfg. Corp., Sales Dept., 46 Oliver St., Newark 5, N.J.]

Alloy Products for Industry

HPAC 102—New types of stainless alloy products with applications in the oil, chemical and petro-chemical industries are described in this new booklet. Some of the products described are industrial expansion joints, 50 and 500 hp gas turbine power plants, ceramic coatings for use on metals subject to high temperature service, shell mold castings of stainless alloys and custom designed items made of stainless steels or super alloys. [Manufacturer: Solar Aircraft Co., 2200 Pacific Highway, San Diego 12, Calif.]

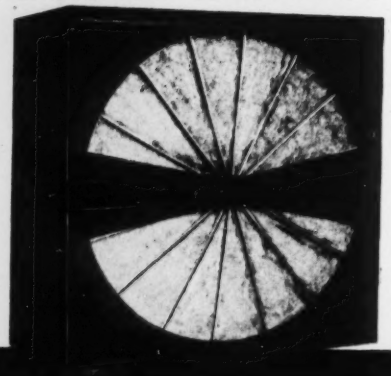
Btu Meter

HPAC 103—Bulletin 1010 gives specifications of a Btu meter designed for particular application in the heating and air conditioning field. The purpose of the instrument is to record and totalize in heat units. Included in the data sheet are applications, principle of operation, specifications and a detailed cutaway diagram. [Manufacturer: Penn Industrial Instrument Corp., Penn Bldg., 4110 Haverford Ave., Philadelphia 4.]

Control Equipment Maintenance

HPAC 104—What to look for in maintaining control equipment is told in an eight-page manual, *Proper Mainte-*

HOLDS DOWN EQUIPMENT NEEDS



by holding heat or cold while exchanging air!

THERM·O·WHEEL

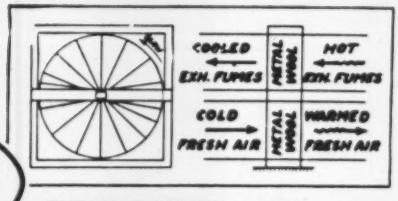
Therm-O-Wheel actually holds up to 96% of your heat or cold by ventilating through the counterflow principle. This means that smaller heating or cooling units can service larger areas efficiently . . . that your present equipment can be run for more economically.

HERE'S HOW:

Therm-O-Wheel sends your counterflowing air streams through rotating metallic wool, which enables complete transfer of temperatures between exhaust and fresh make-up air . . . regardless of temperature differences. As a result, you get constant ventilation with hardly a perceptable heating or cooling loss. Ideal for theatres, assembly halls, industrial-chemical-brewing operations, etc., for winter or summer ventilation.

Write for complete details

Some territories for distributors still open



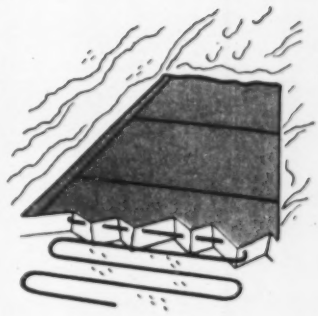
THERM O WHEEL INCORPORATED

THERM-O-WHEEL, INC.

1042 Twenty-Second Street, Far Rockaway, N.Y.

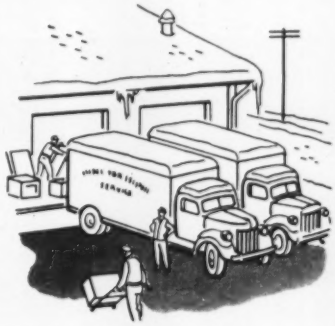
Now is the time to install a snow-melting system with SPANG® CW STEEL PIPE

1. This is the old unsatisfactory way to remove snow. With it goes the danger of injury through straining and overexertion . . . or accident claims resulting from falls on improperly cleared walks . . . or delays and inconveniences to customers.



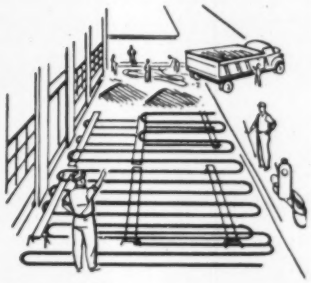
2. But a modern snow-melting system with SPANG CW Steel Pipe saves labor costs on snow removal, eliminates the need for chemicals, ashes or sand and avoids accident hazards. It's easy to install, and everybody benefits. For instance . . .

3. It eliminates caked snow or icy spots on areas in front of stores, airports, clubs, hotels, office buildings, and apartments—a real service which customers and tenants appreciate.



4. Driveways, loading platforms, service station drives and garage entrances are accessible all year around regardless of weather—no delays on deliveries or customer service.

5. In residential areas, too, a snow-melting system eliminates a tiring chore, and keeps driveways, walks and steps clear in any weather from a light snowfall or ice storm to a blizzard.



6. Snow-melting systems with SPANG CW Steel Pipe to meet your local winter weather conditions can be tied in with an existing heating system or as an independent installation.

Don't Put it Off!

Now, while the weather is warm, is the time to install a snow-melting system with SPANG CW Steel Pipe. Spang Pipe is quality-controlled in manufacture, which makes it easy to cut, bend, thread and weld . . . saves installation time and assures years of dependable and trouble-free service.

Your local Spang distributor carries a complete line of Spang Pipe and fittings. See him for all your piping needs.

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DIVISION OF THE NATIONAL SUPPLY COMPANY

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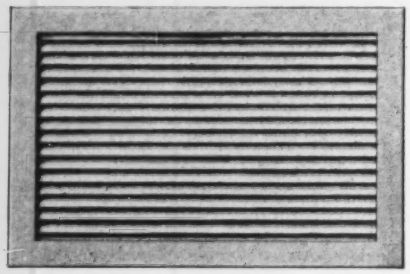
SPANG

You can't see through INDEPENDENT

NO-VISION GRILLES for Doors, Walls and Partitions



No. 1312-R

. . . BUT YOU CAN SEE

Extra Profit Opportunities with the Complete Line of Independent Registers and Grilles

No. 1312-C

Where ventilation without vision is desired—in doors, walls and partitions—Independent No-Vision Grilles meet every requirement. It's impossible to see through an Independent No-Vision Grille from any viewpoint.

Independent No-Vision Grilles are made in two styles—Style C, with grille core only, installed with molding as shown at left; Style R, with overlapping rim on all four sides of one surface of the grille, as illustrated above.

Independent No-Vision Grilles are made in 46 standard sizes, for openings from 8″ x 6″ to 30″ x 24″, and additional sizes can be furnished.

SEND FOR THIS BOOK

Write for new Catalog No. 52—gives schedules of sizes, details and prices of registers and grilles for every purpose.

MEMBER NATIONAL WARM AIR HEATING AND AIR CONDITIONING ASSOCIATION INDOOR COMFORT

Always Leading — Always Progressing

THE INDEPENDENT REGISTER CO.

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nance of Control. Besides giving helpful suggestions toward overcoming some of the most frequent difficulties common to most electrical control devices, the pamphlet has a control trouble-shooting chart for reference showing the symptom, possible cause and cure. The back page of the manual carries a listing of 26 suggested points for checking to assure satisfactory preventive maintenance of control equipment. [Manufacturer: Allis-Chalmers Mfg. Co., 1171 S. 70th St., Milwaukee.]

Controlled Volume Pumps

HPAC 105—Bulletin 553 covers the design and construction of the firm's motor driven controlled volume pumps. Technical data includes capacity-pressure selection tables, types of capacity adjustments, standard and special designs and packaged systems. Also included are charts showing typical applications and a materials selection chart. [Manufacturer: Milton Roy Co., 1300 E. Mermaid Lane, Chestnut Hill, Philadelphia 18.]

Cooling Tower

HPAC 106—This new bulletin describes all features, data and dimensions of the company's "Thrifti-Tower," a small cooling tower for commercial and residential air conditioning systems. The bulletin covers performance characteristics and includes a data and dimension chart giving pump sizes, water flow, motor horsepower and shipping weights. [Manufacturer: Marlo Coil Co., 6135 Manchester Ave., St. Louis 10.]

Desiccant for Refrigeration

HPAC 107—The use of "Permagran" granules as a desiccant in refrigeration systems is described in a folder, done with a novel approach. Titled, *My Life Story*, by A. Permangran Granule, it discusses in semi-technical language the operation of the granules in dehydration work. [Manufacturer: The McIntire Co., Livingston, N.J.]

Duct Insulation

HPAC 108—Design data booklet on "Fiberglas" duct insulations contains more than 40 photographs and drawings of the various rigid and flexible insulations for the exterior and interior of warm and cold air ducts. Included is complete information about the new flexible duct liner, a product recently introduced by the company. This material may be installed on metal sheets before they are bent to form ducts. It is sprayed with a light coating of fire-safe neoprene to prevent erosion by high-velocity air and to reduce frictional losses. [Manufacturer: Owens-Corning Fiberglas Corp., 1911 Nicholas Bldg., Toledo 1, Ohio.]

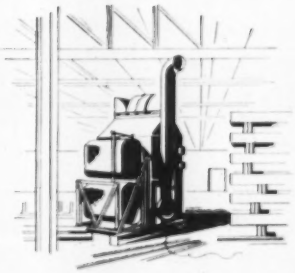
Electrode Booklet

HPAC 109—Pocket-guide, Form ADC 650, for the company's line of electrodes describes more than 30 different electrodes — stainless, mild and high tensile steels, cast iron, nonferrous, low hydrogen and hardfacing. Chemical analysis, procedure for welding and application are included. Other sections in the booklet include "Picking the Right Electrode," mechanical properties and testing of electrodes and AWS-ASTM specifications. [Manu-

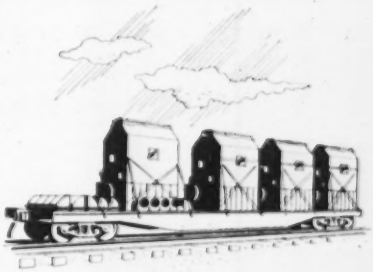
These 12 DRAVO *Counterflo* SPACE HEATERS really got around!

Here's where the Dravo Heater's rugged construction and durability paid off for Ford Motor Company.

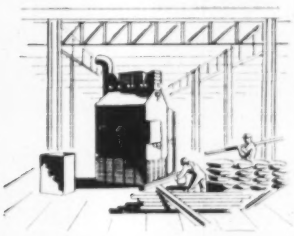
Back in the fall of 1950, Ford purchased 12 Dravo Heaters for temporary heating at Cleveland, Ohio, while Ford's new engine plant was under construction during the winter of 1950-1951.



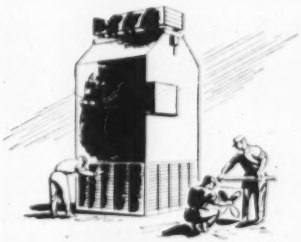
1 The heaters maintained comfortable working conditions and kept the ground from freezing during zero weather so that concrete could be poured.



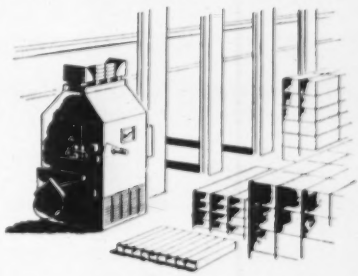
2 After this new plant was completed, four heaters were shipped to Canada and were permanently installed in Ford's warehouse at Winnipeg.



3 The other eight heaters were shipped to Kansas City, Mo., for use as temporary heaters during the construction of facilities similar to those in Cleveland.



4 When that job was finished, the eight heaters were returned to Dravo at Neville Island, Pittsburgh, for overhauling and reconditioning by highly-skilled Dravo personnel.



5 Now these eight Dravo *Counterflo* Heaters have been permanently installed for comfort heating at Ford's assembly plant at Buffalo, New York.

Only Dravo *Counterflo* Space Heaters could stand up under such extraordinary treatment and frequent moving. Dravo Heaters are a product of top-flight engineering and planning; their mill-type, heavy construction means long life, low maintenance and years of satisfactory service.

Dravo Heaters, backed by over 60 years of engineering experience, are available now in a range of sizes from 400,000 to 2,000,000 Btu. Find out how these superior Dravo Heaters can benefit you. Write for more information. Use the coupon.

DRAVO

CORPORATION

PITTSBURGH • ATLANTA • BOSTON • CHICAGO • CINCINNATI
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Dravo Corporation, Heating Department
Dravo Building, Fifth and Liberty Avenues
Pittsburgh 22, Pennsylvania

DRAVO

Send me information about heating for the subjects I've checked, and Dravo Heater Catalog PQ 523-1324.

- ☐ Space heating industrial buildings, warehouses, garages, hangars.
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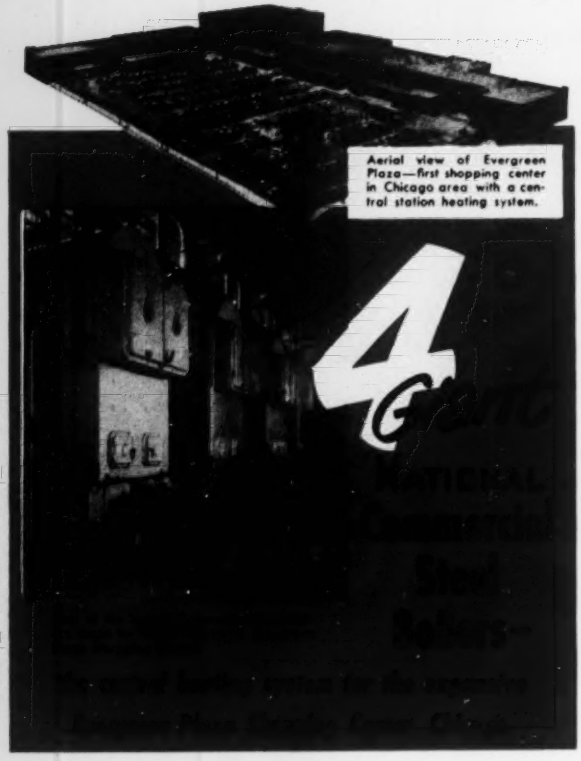
- ☐ Process drying and heat curing.
- ☐ Tempering make-up air.
- ☐ Temporary heating.
- ☐ For use in conjunction with air conditioning.
- ☐ Please have a representative call at no obligation to me.

Name _____ Title _____

Company _____ Address _____

City _____ Zone _____ State _____



Arthur Rubloff—Creator of the Plaza
Howard T. Fisher & Associates, Inc. } Architects
Holabird & Root & Burgee } and Engineers
George A. Fuller Company—General Contractor
H. P. Reger & Co.—Mechanical Contractor

This National multiple boiler installation is the source of year round heating and air conditioning comfort to the 53 rental units in the Evergreen Plaza Shopping Center.

Low pressure steam from these National Boilers is supplied to convectors, radiant baseboard, heating coils and unit heaters—equivalent to 170,000 square feet of direct radiation—through 15 miles of pipe, to heat this $15 million structure's 6,100,000 cubic feet of space. Fully automatic, each of the 53 stores has individual heat distributor controls. Performance has completely satisfied the architects and owners.

Once more, National Boilers are making heating history and demonstrating their engineering excellence and economical operation. Get the full details on National Commercial Steel Boilers.

Write for National Bulletin #507-HF

THE NATIONAL RADIATOR COMPANY
JOHNSTOWN PENNSYLVANIA

facturer: Air Reduction Sales Co., 60 E. 42nd St., New York 17.]

Fin-Tube Radiators

HPAC 110—Four-page illustrated folder describes fin-tube radiators for steam or hot water or high or low pressure systems. Complete description of the product, dimensions and typical installations are shown. [Manufacturer: Lee Vine Fin-Tube Radiator Co., Inc., 10 Fair St., New Haven, Conn.]

Gas and Dual-Fuel Firing

HPAC 111—Form 2359 is a four-page, three-color folder on gas and dual-fuel firing for heating, processing and power. Emphasis is on the advantages of zone fire control for low start and modulated firing permitted by the firm's vertical gas burner, on the features of the "inshot" type of burner, on ring-type burners designed for intermediate and high pressure gas, and on the company's new dual fuel package unit. [Manufacturer: Iron Fire Mfg. Co., 3170 W. 106th St., Cleveland 11.]

Gas Fired Space Heater in Duct

HPAC 112—Bulletin No. 660-60 is a case study report of how a gas fired space heater was built directly into an air conditioning duct system to eliminate the need for a boiler plant. The four-page booklet tells how the heater was adapted to form a part of the central heating and cooling facilities for a modern banking office. Building heat loss and fuel costs are given. [Published by: Dravo Corp., 1203 Dravo Bldg., Pittsburgh 22, Pa.]

Low Hydrogen Electrodes

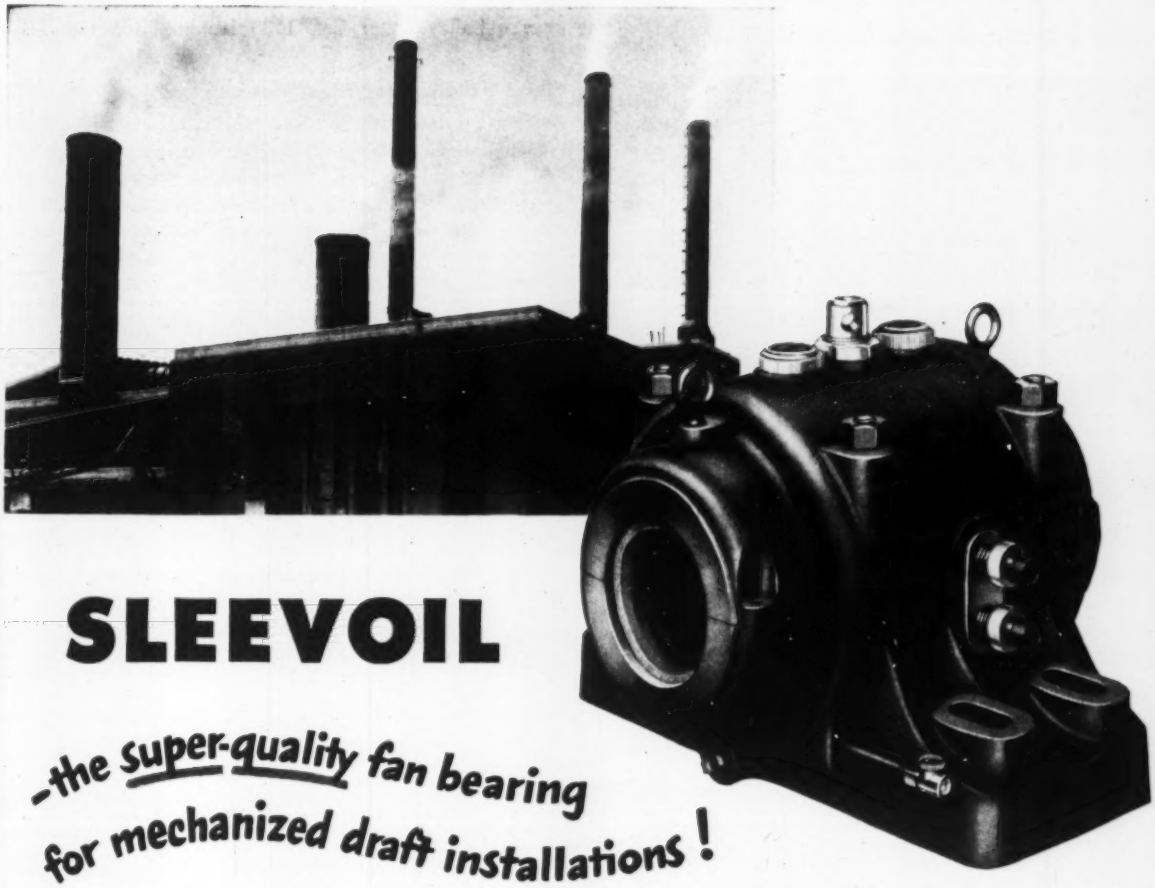
HPAC 113—Bulletin AR53-18 is a technical bulletin by Richard K. Lee, the company's vice president in charge of research, and J. O. Cavanagh, technical director, entitled *The Facts About Low Hydrogen Electrodes*. This bulletin deals with recent technical developments in the low hydrogen electrode field, with chapters devoted to history of this type of electrode, effects of hydrogen, effects of the basic slag, control of hydrogen, welding procedures and applications. [Published by: Alloy Rods Co., York, Pa.]

Lubricated Plug Valves

HPAC 114—Comprehensive booklet describes and illustrates the company's new line of lubricated plug valves, steel and semi-steel. The booklet shows sectional views of various sized plug valves and dimension tables keyed to the sections and to appropriate valve accessories. The manufacturer also has included guidance tables for proper "OIC-Lube" at specified temperature ranges, a compilation of service pressure-temperature ratings and drilling templates for flanges ranging from 125 lb to 250 lb for cast iron and 150 lb to 300 lb for steel. [Manufacturer: Ohio Injector Co., 275 Main St., Wadsworth, Ohio.]

Meters and Controls

HPAC 115—Comprehensive catalog offers information on the firm's line of meters, control equipment and engineering services. It is written for engineers in power plants, public utilities and process plants. Fifteen measured variables common to power and process operations form the index for selecting appropriate metering and control equipment. Basic specifications, illustrations and detailed literature references are included. [Manufac-



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-the super-quality fan bearing for mechanized draft installations!

● Hundreds of generating plants in America run on Dodge Sleevoil Bearings. These famous bearings combine quietness, long life and dependability to a degree unique in the bearing field. They offer engineers of costly power plants a priceless safeguard for their equipment.

Sleevoil Bearings are a Dodge development—created especially to meet the exacting requirements of fan and blower service. They are ideal bearings for important installations calling for induced or forced draft. Designed in cooperation with engineers of leading fan and blower manufacturers, they have a long record of dependable performance in critical service.

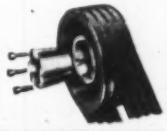
Dodge Sleevoil Pillow Blocks are normally available from stock—in both plain and water-cooled types, in shaft sizes from 1-7/16" to 8". Write us for information.

DODGE MANUFACTURING CORPORATION
1600 Union Street, Mishawaka, Indiana

DODGE
of Mishawaka, Ind.

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on *modern* power transmission machinery for *modern* installations. Look for his name under "Power Transmission Equipment" in your local classified phone book.

FIRST IN POWER TRANSMISSION MACHINERY!



SEALED-LIFE V-BELTS; TAPER-LOCK SHEAVES

TORQUE-ARM SPEED REDUCERS

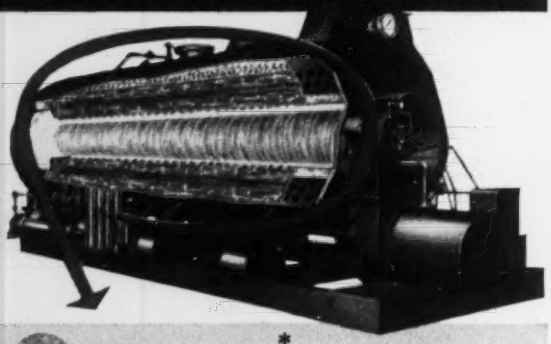
DODGE-TIMKEN PILLOW BLOCKS

ROLLING GRIP AND DIAMOND D CLUTCHES

[redacted]

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, CHICAGO THRIFT-ETCHING CORPORATION, 1555 SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS

THE BIG DIFFERENCE IN PACKAGE BOILERS



CYCLOTHERM* CYCLONIC COMBUSTION gives you

66% MORE POWER per sq. ft. of heating surface

The cyclonic action of the flame revolves evenly in a free spiraling vortex the full length of the furnace and provides an even rate of heat transfer throughout the entire length of the combustion chamber.

This controlled combustion reduces heating surface requirements from 5 to just 3 sq. ft. per B. H. P. giving 66% more power.

Plus These Important Features

- Saves up to ⅓ the Space of Conventional Package Units
- Guaranteed 80% Minimum Efficiency
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- Burns Oil, Gas or Both
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- No Expensive Stacks or Foundations to Build
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And That's Not All . . .

Cyclotherm Steam Generators with *patented* Cyclotherm Cyclonic Combustion gives you: Full power operation from a cold start in 15 to 20 minutes; Built in accordance with A.S.M.E. and Nat'l. Board Standards and bears the label of Underwriters Laboratories Inc.; Complete range of sizes from 18 to 500 h.p., 15 to 200 psi operation pressure.

WRITE TODAY for your copy of "All Your Questions Are Answered by Cyclotherm" and find out why Cyclotherm Steam Generators have been proven superior in thousands of installations. Just drop a post card to Cyclotherm, Dept. 26 Oswego, New York.

*Reg. trade name

CYCLOTHERM STEAM GENERATORS

turer: Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland 10.]

Noise Isolation for Fans, Motors

HPAC 116—Vibration and noise isolation bases for fans and motors are described in detail in Catalog FB-302. The catalog gives illustrations, descriptions and specifications of vibration isolation equipment manufactured by the company. Several case histories are included. [Manufacturer: The Korfund Co., Inc., 48-01-F, Thirty-Second Pl., Long Island City 1, N.Y.]

Nozzles for Oil Burners

HPAC 117—Catalog "O" covers the company's line of domestic and industrial oil burner nozzles, conventional air cones and stabilizers, combustion heads, anti-pulsating equipment and pressure regulating valves and strainers. Several tables show capacities, spray angles, dimensions and recommended combinations. Photographs and line drawings illustrate the various products. [Manufacturer: Monarch Mfg. Works, Inc., 2501 E. Ontario St., Philadelphia 34.]

Pressurized Manometer

HPAC 118—The operation and application of the firm's pressurized manometer is described in Bulletin 28. According to the manufacturer, this instrument measures absolute pressure, gage pressure or differential pressure up to 600 in. of mercury or water. The pressurized manometer principle is thoroughly explained and illustrated in the booklet. Also included is a typical schematic flow diagram for a pressurized manometer unit. Copies of the bulletin are available upon receipt of a letterhead request. [Manufacturer: The Meriam Instrument Co., 10920 Madison Ave., Cleveland 2, Ohio.]

Refrigeration Conversion Tables

HPAC 119—This plastic pocket-card contains altitude and refrigeration conversion tables for designers, refrigeration engineers and servicemen. One tables converts altitude to pressure in inches of mercury, pounds per square inch, and millimeters of mercury. The other side gives pressures of "Freon 13, 22, 12 and 11," over a wide range of temperatures. [Available from: Tenney Engineering, Inc., 26 Avenue B., Newark 5, N.J.]

Rosin Core Solder

HPAC 120—Bulletin No. 158 describes "RTS 200" a rosin core solder. It is available in a wide variety of wire sizes, compositions and quantities. [Manufacturer: Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York.]

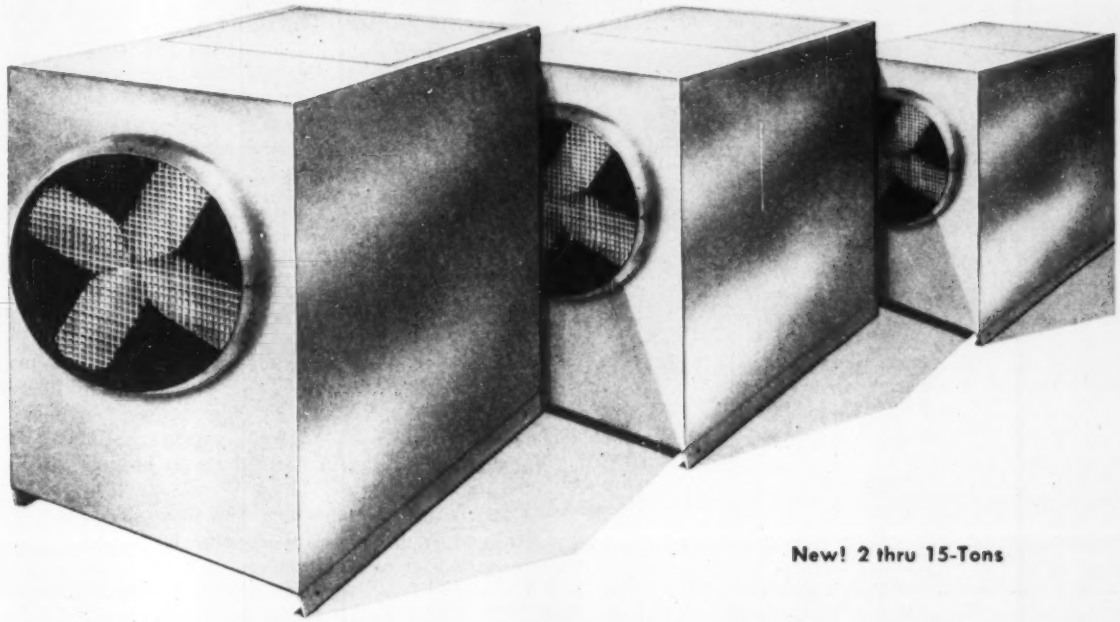
Low Temperature Insulation

HPAC 121—New 24-page booklet, Foamglas: Low Temperature Space Insulation for Walls, Ceilings, Floors, contains information on the application methods. It lists finishes, suggested thicknesses, insulation values and properties of "Foamglas." Illustrative drawings and photographs show actual installations. [Manufacturer: Pittsburgh Corning Corp., One Gateway Center, Pittsburgh 22 Pa.]

Stress Rupture Data for Tubing

HPAC 122—Data card TDC-153 presents stress rupture data on a number of the company's "Croloy" tubing steels

RESIDENTIAL COOLING TOWERS



New! 2 thru 15-Tons

ONLY HALSTEAD & MITCHELL OFFERS THE

20-Year Guarantee!

ON THE WETTED DECK SURFACE

PRICED FOR THE HOME MARKET

Price-wise these Halstead & Mitchell Residential Cooling Towers throw open huge segments of the home and small building market to air-conditioning. Here is the development for which the industry has been waiting. Check prices today!

NOW REQUIRED IN MANY AREAS

Residential Cooling Towers recirculate precious water . . . meet requirements of municipalities which prohibit wasting cooling water to sewers. And low cost H&M units take residential air conditioning to the suburbs and rural area . . . recirculate from a cistern if need be!

MADE FOR REAL OPERATING ECONOMY

Economical, lastworthy . . . low operating cost matches low initial cost. Efficient gravity-type distributing pan eliminates windage loss since atomizing by spray nozzle is unnecessary. Low pump head pressure is another bonus of gravity distribution. And maintenance is a snap!

FAMOUS HALSTEAD & MITCHELL QUALITY

Here's *all* the quality for which Halstead & Mitchell Cooling Towers are world famous — including the 20-year Guarantee on the wetted deck surface of pressure-treated creosoted wood, against attack by rotting or fungi growth. Stainless steel fans and shafts, plus individual cabinet coatings of Vinsynite, Vinyl Zinc and chlorinated rubber add important years of life. The complete assembly is with Everdur bolts . . . disassembly is easy even after years of service.

AT LEADING WHOLESALERS EVERYWHERE

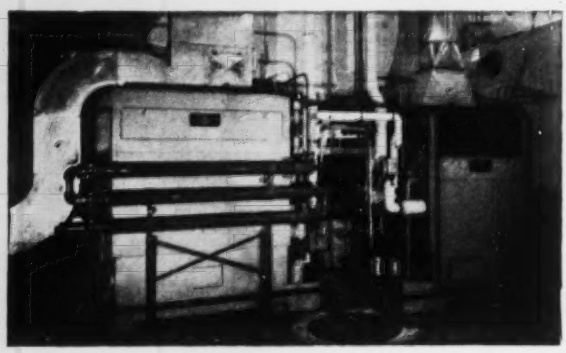
Write for descriptive bulletin from Halstead & Mitchell, one of the world's largest manufacturers of water-cooled Cleanable Condensers, and Cooling Towers up through 100-tons.

Halstead & Mitchell

OFFICES: BESSEMER BUILDING • PITTSBURGH 22, PA.

This NEW METHOD DRIES AIR

PRECISELY AS YOU WANT IT



NIAGARA CONTROLLED HUMIDITY AIR CONDITIONING

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

Most compact, taking less space for installation.

Inexpensive to operate because . . . no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

For complete information write

NIAGARA BLOWER COMPANY

Over 35 Years of Service in Industrial Air Engineering

Dept. HP. 405 Lexington Ave. New York 17, N. Y.

Sales Engineers in Principal Cities of U. S. and Canada

and other materials designed for high temperature service. The stress rupture test is an overloaded creep test which is continued to actual failure of the specimen. [Manufacturer: Tubular Products Div., Babcock & Wilcox Co., Beaver Falls, Pa.]

Trencher

HPAC 123—Eight-page bulletin describes the improved "Model 92 Baby Digger" now equipped with a 4-speed motor transmission. The center spread of the bulletin contains information on the design and construction of the 92. A table of digging wheel and traction speeds furnished by the new transmission is shown. Action photographs illustrate job applications and complete dimensions and specifications are given, including a table of optional digging widths. Copies of the bulletin may be obtained by writing for it on company letterhead. [Manufacturer: Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17.]

Valve Catalog

HPAC 124—One of the most complete and comprehensive valve catalogs ever published is now off the press and being distributed. This 506-page volume, featuring a special 24-page Valve Selector Guide and more than 100 pages of reference data, describes the company's line of steel, iron and bronze valves, lubricating devices, boiler mountings, cocks and other products, including the new "Non-Slip" handwheel.

The completely illustrated and thumb-indexed selector guide, which groups valves according to the pressure classifications, enables engineers to find specifications, reference data and code requirements in a matter of seconds.

The volume is being distributed personally by the company's sales representatives and distributors. Copies of the catalog may be reserved by writing to the Lunkenheimer Co., P.O. Box 360, Annex Station, Cincinnati 14.

Vertical Turbine Pumps

HPAC 125—Bulletin No. W-150-B11 describes the company's vertical turbine pump and gives suggestions for applications along with photographs of installations. The bulletin also emphasizes the company's research, engineering and testing facilities coupled with installation and servicing facilities available through its distributors. [Manufacturer: Worthington Corp., Advertising and Sales Promotion Dept., Harrison, N.J.]

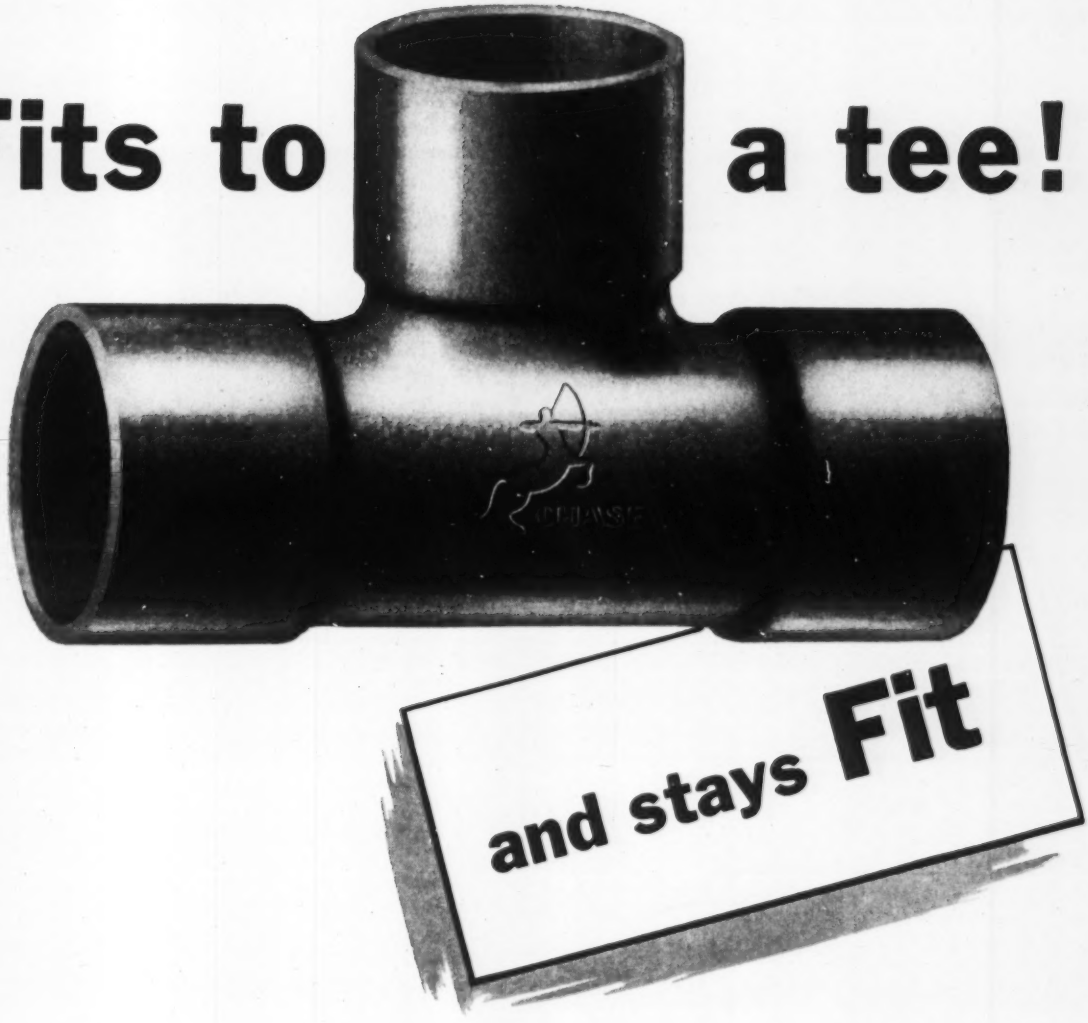
Vibration Isolators for Piping

HPAC 126—Bulletin V/S describes "Flexon Vibra—Sorbers," and contains specifications and installation instructions. This product is designed to isolate vibration from connecting suction and discharge lines to refrigeration and air conditioning machinery, pumps and turbines. Illustrated in the bulletin are some typical applications. [Manufacturer: Flexonics Corp., 1391 S. Third Ave., Maywood, Ill.]

Wall Radiation

HPAC 127—Catalog WR-C3 covers the company's latest line of wall radiation. Data included covers uses, engineering data, specifications and dimensions. New features of this radiation include interlocking fin design, channel-reinforced covers and overlapping cover sections. Basic layout drawings are given. [Manufacturer: Fedders-Quigan Corp., 57 Tonawanda St., Buffalo 7, N.Y.]

Fits to a tee!



even under 5,000 pounds per square inch pressure

It takes only minutes to make a Chase solder-joint that will stand up for years. In actual tests on assemblies of one-half inch Chase Copper Tube and Chase Solder-Joint Fittings, they have withstood over 3,400 pounds pull and 5,000 pounds per square inch water pressure.

Chase Flared Connections, too, are easy to make, tough to pull apart. Of course, all Chase fittings are corrosion-resistant, won't clog with rust. So for anything from drainage lines to radiant panel heating, be sure you specify Chase Copper Tube and Fittings. They assure better flow, longer life.

Chase BRASS & COPPER

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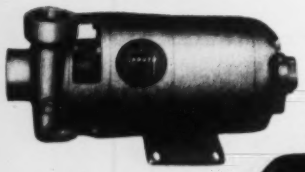
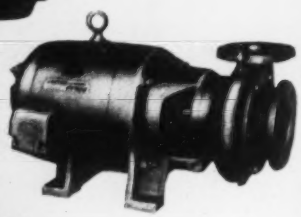
Baltimore	Cleveland	Houston	Milwaukee	New York	Rochester †	Waterbury
Boston	Dallas	Indianapolis	Minneapolis	Philadelphia	St. Louis	(† sales office only)

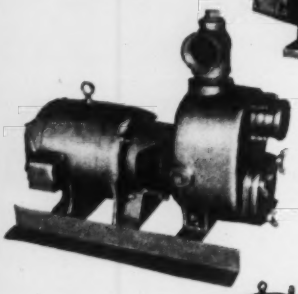
Got a Pumping problem? Let CARVER Help You Get Top Performance!



MODEL B ELECTROPUMP
5 to 70 G.P.M.



TYPE L ELECTROPUMP
30 to 900 G.P.M.



MODEL "K" PUMPS
Self-Priming
20 to 4000 G.P.M.

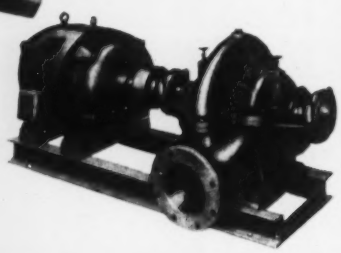


Fig. "400"
SPLIT-CASE PUMPS
200 to 2000 G.P.M.

Whatever your requirements there is a pumping unit in CARVER'S Complete Line that will fit your needs to a "T". On the easy jobs or the tough ones, the outstanding performance, inherent high efficiency and improved hydraulic design of CARVER PUMPS give you thoroughly dependable operation with full pumping economy . . . your best buy for better pumping. A few of them are illustrated.

Ask CARVER for the answer to your pumping problems . . . today. Give us the conditions, we'll give you the answer.

CARVER PUMPS are available with motor, gasoline engine, diesel or belt drive.

CARVER PUMP COMPANY
1460 Hershey Ave., Muscatine, Iowa

CARVER
the quality name in pumps

WE HEAR THAT

H. ROSS WIGGS, architect, and *WIGGS WALFORD FROST & LINDSAY*, consulting engineers, have announced the removal of their offices from 1411 Crescent St. to their own building at 4350 Sherbrooke St., West, Westmount, Montreal 6, Que.

WORTHINGTON CORP. has begun construction of a new plant in Decatur, Ala., for the manufacture of air conditioning equipment. It is estimated that the initial plant and equipment will represent an investment of approximately $3,500,000 and will employ up to 400 persons. The building, which is expected to be completed by November, is designed without windows, will contain more than 160,000 sq ft of floor space and will be completely air conditioned. An office building containing 10,000 sq ft of floor space also will be built.

SAM P. WALLACE, former president of a mechanical contracting firm in Dallas and Houston, resigned this position and has formed the *SAM P. WALLACE CO., MECHANICAL CONTRACTORS*, with headquarters at 400 Tower Petroleum Bldg. in Dallas. Plans are being made for the establishment of a Houston branch. According to Mr. Wallace, the new firm will service a wide area of states with heating, air conditioning, ventilating, process piping, power plant work, plumbing, sewerage and water treatment plants, and similar projects. New members of the staff include *CARL P. WALLACE, JR., RALPH C. BAILEY, A. F. SHANNON* and *FRED G. BRAND*.

To mark its 75th anniversary, the *DODGE MFG. CORP.*, Mishawaka, Ind., entertained the families of employees and representatives of publications at an open house last month. Tours of the plant and explanations of the production processes featured the occasion. More than 6000 types and sizes of power transmission products are shown in the company's current catalog.

The *COOPER ALLOY FOUNDRY CO.* has announced the extension of their product line to include plastic pumps, valves, accessories and fittings. To meet the demand for these products, the company has acquired interest in the Vanton Pump Corp. of New York, producers of a plastic pump and polyethylene valves and fittings.

An electrode plant, recently built by *HOBART BROTHERS CO.* in Troy, Ohio, now is in full production. Facilities include shipping and receiving docks for both rail and truck transportation, chemical and wire storage facilities, production, quality control, testing, research and experimental departments.

Salesmen for the *WESTINGHOUSE ELECTRIC CORP.* now are using a miniature two-section model of the "MU" self-contained air conditioning unit for quick desk-top demonstrations. The top fan section can be shifted to any of 10 discharge positions showing how the unit can be adapted to individual space requirements. Small

Once is not enough!

The need for blood is greater than ever, not only for men wounded in combat, but here at home . . . to cure disease, to meet accidents and disasters, and to prepare for civil defense.

Our quota can ONLY be met, if those who give *keep on* giving . . . regularly!

You CAN give more than once . . . as often as every three months with complete personal safety. The more often you give the more often you save a life. For every pint of blood you give goes to someone who needs it desperately.

Remember . . . once is NOT enough. Give blood again and again! Call your Red Cross, Armed Forces or Community Blood Donor Center for an appointment to give blood today.

GIVE BLOOD

...give it again and again

BUSINESS EXECUTIVES!

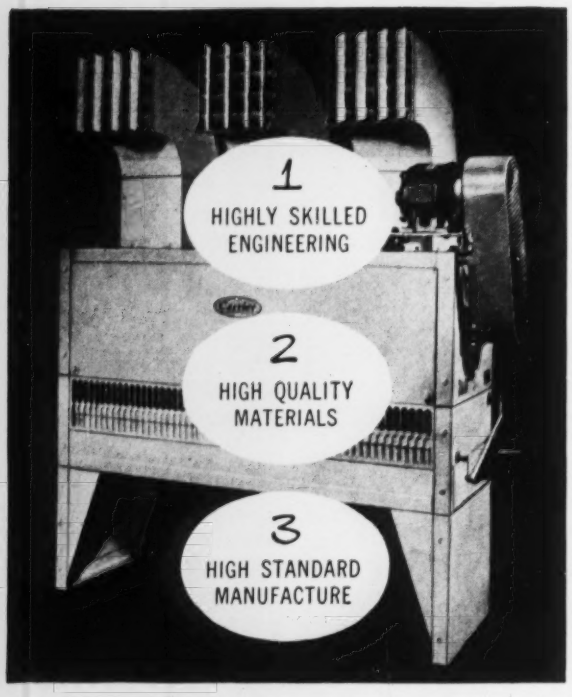
CHECK THESE QUESTIONS

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- ◯ HAVE YOU GIVEN YOUR EMPLOYEES TIME OFF TO MAKE BLOOD DONATIONS?
- ◯ HAS YOUR COMPANY GIVEN ANY RECOGNITION TO DONORS?
- ◯ DO YOU HAVE A BLOOD DONOR HONOR ROLL IN YOUR COMPANY?
- ◯ HAVE YOU ARRANGED TO HAVE A BLOOD-MOBILE MAKE REGULAR VISITS?
- ◯ HAS YOUR MANAGEMENT ENDORSED THE LOCAL BLOOD DONOR PROGRAM?
- ◯ HAVE YOU INFORMED EMPLOYEES OF YOUR COMPANY'S PLAN OF CO-OPERATION?
- ◯ WAS THIS INFORMATION GIVEN THROUGH PLAN BULLETIN OR HOUSE MAGAZINE?
- ◯ HAVE YOU CONDUCTED A DONOR PLEDGE CAMPAIGN IN YOUR COMPANY?
- ◯ HAVE YOU SET UP A LIST OF VOLUNTEERS SO THAT EFFICIENT PLANS CAN BE MADE FOR SCHEDULING DONORS?

Remember, as long as a **single** pint of blood may mean the difference between life and death for **any** American . . the need for blood is **urgent**!

NATIONAL BLOOD PROGRAM



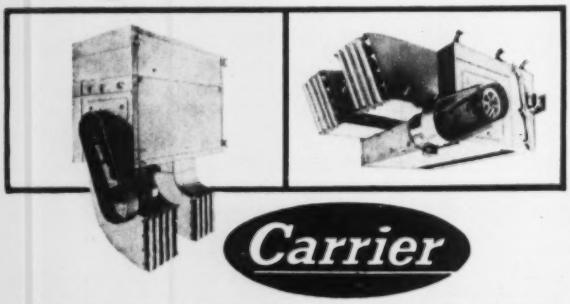
They make the difference in
Carrier Heat Diffusers

...a difference that is fundamental; that leaves no doubt about the high efficiency, economical operation and long-lasting construction of these extremely flexible and easily installed units.

Compact and sturdy,* Carrier blower-fan type sectional Heat Diffusers are designed and built especially for heating and ventilating large areas in factories, warehouses, garages, hangars, commercial and industrial buildings.

Floor Mounted, *Horizontal Suspended*, and *Vertical Suspended*, as illustrated. Each type in six basic sizes. Capacities from 115,000 to 2,390,000 Btu's. Steam or hot water. Either right or left hand coil connections.

*For example, all sections are rigidly die formed from heavy gauge steel and integrally welded. For complete list of features, specifications, and selection data, write to Carrier Corporation, Syracuse, New York.



Carrier

AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING

magnets inside the demonstrator hold the upper fan section in position.

Another demonstration unit being used by Westinghouse is a display kit that converts stock models of "Unitaire" air conditioners to models suitable for exhibition at trade shows. The kit consists of a plastic front panel plus lighting fixtures for internal illumination of the unit. With this feature, distributors can take a unit from stock, make a display model, and then later replace the standard panel and return it to stock.

DU PONT CO.'s educational exhibit and lecture on development, properties and uses of "Freon" refrigerants now has been presented to more than 8600 refrigeration servicemen and contractors in 45 states over a 16-month period. The exhibit, designed to help servicemen provide better refrigeration and air conditioning maintenance, uses slide films and simplified laboratory experiments to demonstrate the development and properties of "Freon."

RICHARD K. WEST, president of Taco-West Corp., has announced the change of his company's name to *WEST INSTRUMENT CORP.* The company, which will have no change in officers or directors, will continue to operate its office and plant at 525 N. Noble St., Chicago.

The *MEYERCORD Co.*, 5323 W. Lake St., Chicago 44, is offering a decal showing decimal equivalents in 64ths to engineers, designers, draftsmen, etc. The complimentary decal is 6 by 1¼ in. and is designed for application to slide rules, T-squares, drawing boards, desk tops and other similar drawing equipment.

The Hoover Co. of North Canton, Ohio, has announced that its Kingston-Conley Div. of North Plainfield, N.J. now will be known as *THE HOOVER CO., ELECTRIC MOTOR DIV.* The new title is intended to be more descriptive of the division's operation as manufacturers of electric motors.

Seventy-one salesmen of *TIMKEN—SILENT AUTOMATIC* heating equipment recently completed a week-long course in the first of a series of sales training schools planned for this summer. These sales training courses are designed to provide sales training for new retail salesmen of Timken dealers throughout the country. Conducted under the direction of *R. M. MARBERRY*, national sales manager, the courses of study include company history, product application, installation and service relationship to sales, types of heating and control systems, sizing conversion burners, heat loss calculations and sizing units, sizing water heaters, sales use of technical knowledge, sales features, salesroom demonstrations, working with architects and builders, and advertising.

Member companies of the *PROPELLER FAN MANUFACTURERS' ASSOCIATION* now are using a new product tag. The tag is designed for attachment to the residential and industrial fans manufactured by the association members. The cover of the tag carries the

New Modular MULTI-VENT® concealed ceiling panels

COSTS LESS TO INSTALL

than ordinary air diffusers!

Yes! That is the big news in commercial, institutional, and industrial air conditioning for 1953.

Now you can install this superior low velocity pressure displacement type of air distribution for metal pan ceilings at a far *lower* cost than the high velocity injection type.

This is possible because the new MODULAR PANELS are so extremely simple and easily positioned. They can be assembled and installed in a few seconds by hand without the use of tools —a tremendous saving in labor cost!

Distributing air by Multi-Vent's gentle pressure displacement assures perfectly even air motion, and exceptional uniformity and control of room temperatures. The total absence of strong air streams or blow eliminates all the usual sources of draft complaints and permits complete freedom in locating panels and in relocating partitions.

Write today for detailed literature.

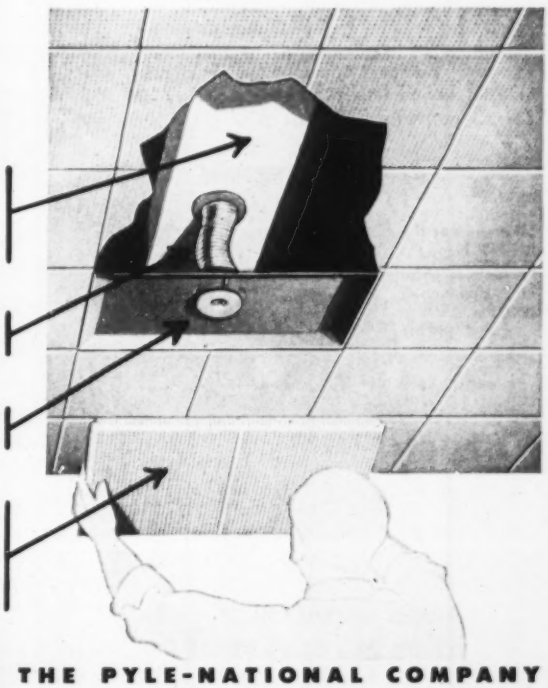
LABOR SAVING INSTALLATION FEATURES

■ **ADAPTABLE** . . . Duct can be shop built with 3-inch diameter openings at approximate panel locations. Duct work can be installed, flexible tubes with valve snapped in, and system balanced prior to and independent of ceiling erection. Panels can be located without regard to position of lighting fixtures and partitions.

■ **FLEXIBLE** . . . compressible tubing permits wide latitude in alignment, thus radically reduces installation cost by eliminating all need for time consuming close fitting sheet metal work.

■ **ADJUSTABLE** . . . orifice valve can be simply set by wing nut for varied amount of air delivery. Individual panel adjustments do not disturb the overall balance of the system.

■ **COMPLETELY CONCEALED** . . . ANY STANDARD PERFORATED 12" x 24" ACOUSTICAL METAL CEILING PAN (supplied by the ceiling contractor) functions as the distribution plate for the MODULAR MULTI-VENT PANEL. The panel simply replaces the acoustical pad and nests snugly in the pan which snaps into ceiling tee runner, unhampered. Ceiling face is undisturbed.



MULTI-VENT DIVISION THE PYLE-NATIONAL COMPANY

Sales and Engineering Representatives in Principal Cities of United States and Canada 1373 North Kostner Ave. Chicago 51, Illinois

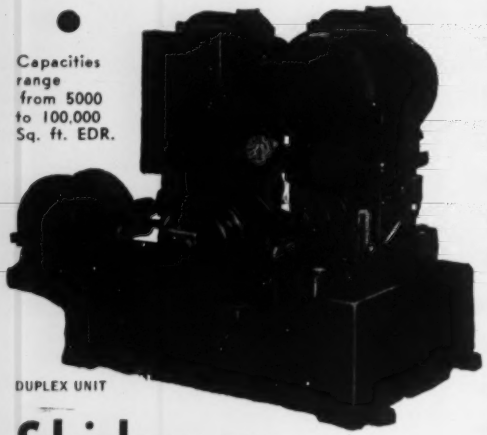
PUT THE RIGHT PUMP ON THE JOB

Skidmore

Vacuum Pumps remain constant year after year without adjustment or expensive repairs . . . priniciple of construction eliminates the necessity of close clearances between moving parts.

duplex ?? single

Capacities range from 5000 to 100,000 Sq. ft. EDR.

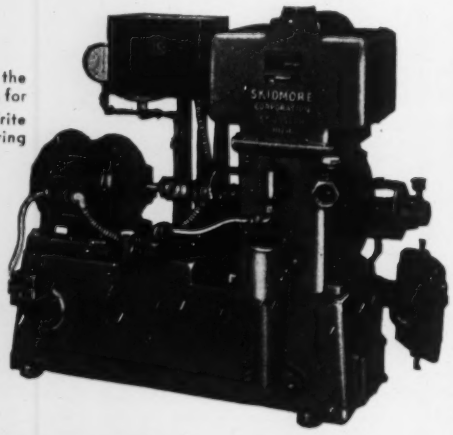


DUPLEX UNIT

Skidmore

Vacuum pumps operate automatically, quietly, economically and dependably under all normal conditions.

Skidmore has the RIGHT Pump for the job. Write for engineering bulletins.



SINGLE UNIT.

MAINTAINED SKIDMORE PUMPS PEERLESS

SKIDMORE COKPORATION, ST. JOSEPH, MICHIGAN

SKIDMORE PUMPS

copyrighted "Certified Ratings" label which signifies that the fan has been tested and rated in accordance with U.S. Dept. of Commerce Commercial Standard CS 178-51. The inside copy on the new three-color tag is an explanation of air delivery ratings and fan performance standards plus some suggestions for proper care of the fan.

YORK-SHIPLEY, INC., of York, Pa., is building a new series of factory buildings, all east of York. All manufacturing will be concentrated in these buildings when the project is completed. The initial production run through the first plant completed resulted in a reduction of prices for the firm's steam generators in sizes of 150 hp and up.

Sales representatives of the *NATIONAL RADIATOR CO.* recently met at Altoona, Pa. for the second general sales conference held by the company in the last three years. Part of the 1953 conference consisted of graduation ceremonies for 16 sales trainees who had just completed a month's course in the theory and application of basic heating engineering.

The *GENERAL CONTROLS CO.* headquarters plant in Glendale, Calif., recently was expanded and now covers 11 acres. In addition to this plant, the company now operates a new 60,000 sq ft facility in Skokie, Ill., and branch offices in 34 cities.

Largest in the recent series of schools conducted by *IRON FIREMAN MFG. CO.* for its dealers was a five-day meeting at the company's Cleveland plant, held recently. The school, under *S. H. BEACH's* supervision, industrial sales manager, provided study of service and installation engineering of all types of the company's commercial-industrial automatic heating and power equipment.

PENN CONTROLS, LTD., Canadian subsidiary of Penn Controls, Inc., has completed the moving of its entire operation into a newly constructed modern factory and office building at 929 Warden Ave., Scarboro, Ont., on the eastern outskirts of Toronto.

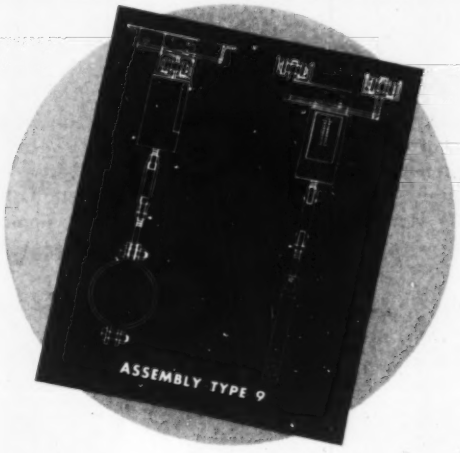
The third pig iron producing blast furnace recently was put into operation by the *KAISER STEEL CORP's.* plant at Fontana, Calif. Identical to the other two blast furnaces at the Fontana plant, the new furnace completes the major portion of the company's $65 million expansion program.

F. J. WRIGHT UTILITIES, LTD., of Strathroy, Ont., has completed arrangements with *E. R. CARPENTER* of Cleveland, for the sales, throughout Canada, of the Carpenter "Monolithic Floating Floor and Piping System" for ice skating rinks.

Ceremonies were held recently by the *JOHNS-MANVILLE CORP.* marking the 60th anniversary of the initial mining of the diatomite deposit at Lompoc, Calif. *PRESIDENT A. R. FISHER* addressed a special dinner meeting

HOLD EVERYTHING ...with

BLAW-KNOX OVERHEAD ROLLER ASSEMBLY



Type 9 Functional Assembly (illustrated) provides free rolling action in two directions and freedom of movement in vertical position. Its *internal swivel* action gives full control over all movements, and minimizes absorption of piping thrusts by the connecting flanges . . . a big help in keeping maintenance and replacement costs at rock bottom. Available for all standard size piping. Accommodates operating loads up to 12,000 lbs.

Catalog No. 53 on reques

BLAW-KNOX COMPANY
POWER PIPING AND SPRINKLER DIVISION
PITTSBURGH 33, PA.

BLAW-KNOX

CUSTOM BUILT— QUANTITY PRICED

atlas BOILER JACKETS

YES, Atlas combines highest quality with lower costs by using basic styles and eliminating tooling costs. You can get boiler jackets custom built to your specifications from ATLAS at prices that will surprise you. ATLAS offers three flush type boiler jacket styles to meet manufacturers' demands. All are of heavy gauge steel, with baked enamel finish, ready for quick installation. You'll find them all the last word in appearance and value.

ECONOMY

Square type construction is featured in this model. In spite of its fine appearance Economy is competitive in price. Ideal for large scale housing projects where price is a major factor.

QUALITY

The richness of the round-cornered top is combined with the simplicity and economy of the square-cornered body. This style is competitive in price with all standard construction designs.

DELUXE

This fully round-cornered design is Deluxe in every way. The full radius on all corners lends massiveness and beauty to its expensive appearance. Use Deluxe for your select dealer trade at surprisingly low cost.

Atlas also manufactures cabinets for heating, cooling and air conditioning units, and furnace cabinets of any style. We will be glad to quote cost estimates on any type of boiler jacket or cabinet on receipt of your specifications and requirements.

Atlas MANUFACTURING COMPANY

EUSTIS AT ROBBINS ST • ST. PAUL 4, MINN.

DURABILITY is designed into the Badger Directed-Flexing, Self-Equalizing Joints:

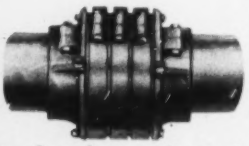
1 each corrugation is designed with the proper depth for its diameter; each diameter is gauged to its proper traverse.

2 each corrugation—and it's the Badger ***all curve*** corrugation—is shaped to flex by Directed Flexing using matching shaped equalizing rings to guide and control the flexing movement. The corrugation wraps and unwraps itself, using the rings as the bearing surface, distributing the flexing stresses evenly over all areas of each of the all-curve corrugations.

3 each corrugation is progressively controlled and limited to its proper flexing traverse.

4 the corrugations are formed from a single metal tube of suitable length by a special forming process which minimizes forming stresses in the metal.

5 every joint is scientifically heat-treated at each of several key steps in its manufacture.



The many thousands of Badger Directed-Flexing, Self-Equalizing Expansion Joints in service now for many years are in themselves testimonials as to their durability. They will serve you equally well. With a wide range of sizes in either flanged or welding end design, with a choice of several metals, with facilities for designing special joints, why not let our expansion joint specialists take care of your requirements?

BADGER MANUFACTURING COMPANY

Original and Sole Manufacturer of Badger Expansion Joints

230 BENT STREET • CAMBRIDGE • MASS.

of the Lompoc Chamber of Commerce, attended by California state officials and executives of the corporation. He discussed the potential uses of diatomaceous earth and its present industrial uses as a filter aid and as a filler in paper, plastics, paints and polishes and as a high-temperature insulating material.

DOLE REFRIGERATING CO. has begun a $100,000 expansion and remodeling program at its Chicago headquarters. All new office facilities are being built on the second floor of the Dole plant. First floor space presently being used for the general offices and a new addition to be built will provide approximately 6000 sq ft of additional factory space. It is expected that construction will be completed in three months.

Distributors, including some representatives from the Standard Oil Co. of Ohio, recently attended a service and installation school on industrial oil burners sponsored by *PETRO*, Cleveland. The school, supervised by *JESS R. CREWS*, Petro sales manager, was designed to acquaint distributors with the most recent changes in the firm's oil burner design.

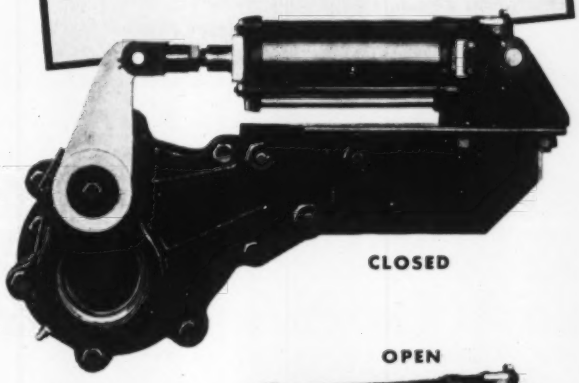
A deposit of nickel ore, estimated to amount to approximately 40 millions tons, has been discovered in Cuba in the vicinity of Moa Bay, about 500 miles east of Havana. Officials of the *FREEPORT SULPHUR CO.*, who plan to build a pilot plant nearby for the recovery of nickel and cobalt, said that except for certain deposits in Canada, the Moa Bay ore bodies constitute the most important proved source of nickel in the world.

The *A. O. SMITH CORP.* recently created and erected what company officials say is the first glass lined smoke stack in industrial history. The 3 ton section, 14 ft in length and 6 ft in diameter, will form the top section of an 85 ft stack at the firm's Milwaukee plant. Using techniques developed in its ceramics laboratory, the stack section was coated inside and out with two glass linings each about five one-thousandths of an in. in thickness. Special acid resisting glass manufactured by the company is designed to combat the normal corrosion of metal caused by acid condensate in the smoke. The stack will be kept under observation for several years.

RAMSET DIV. of *OLIN INDUSTRIES, INC.*, has announced that its newest fastening tool, the "Ramset Jobmaster," has been approved by the New York State Department of Labor for use throughout the state. The new tool, designed to be operated with one hand, is used to fasten steel to steel, steel to concrete, and wood to either steel or concrete.

The Kold-Hold Mfg. Co. has announced a change in its corporate name to *TRANTER MFG., INC.* The change was voted by stockholders who felt that the name was no longer descriptive of the wide variety of refrigeration and heating products now being manufactured by the company. *JAMES R. TRANTER*, president and general manager, said that the name change will have no effect on ownership of the company or its corporate structure.

Everlasting Cylinder-Operated Valves



CLOSED

OPEN

Write for full information

Assure most accurate control of process work by using these units, which eliminate operator fatigue, can be regulated to operate at any speed and in automatic cycles, and can be remotely controlled either electrically or manually. These valves also have the straight-through flow and drop-tight seal which have made the non-wedging EVERLASTING Valves famous for almost half a century.

EVERLASTING VALVE CO., 49 Fisk St., Jersey City 5, N. J.

Everlasting Valves

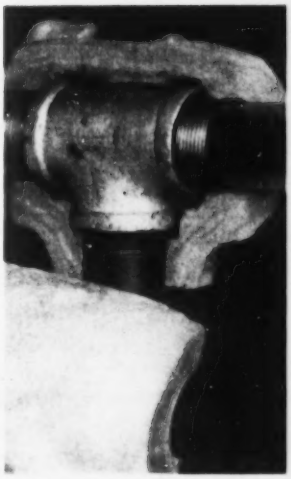
FOR EVERLASTING PROTECTION

EV-369

TRADE MARK "EVERLASTING" REG. U.S. PAT. OFF

"LABOR MUCH LESS"

"GREATLY DECREASES HEAT LOSS FROM STEAM LINES"



These quotes from a letter recently received tell in 10 words the important advantages of

NICOLET *Pre-Formed* FITTING INSULATION

With permission of Henry Frey, president of Industrial Piping & Engineering Co., Fort Wayne, Indiana, we quote in full his letter of May 6, 1953:

> We are at present completing the heating and power plant piping for the Crosley Division of the AVCO Manufacturing Corporation at Evendale, Ohio. We have installed for the first time Nicolet prefabricated pipe fitting insulations and find that, while the initial cost is somewhat greater, the labor is much less, which on the overall picture creates a saving. The insulation qualities of Nicolet insulations are the same as the pipe covering, which, in turn, greatly decreases the heat loss from the steam lines.

Nicolet Pre-Formed Insulation comes in molded shapes and sizes to fit all ells, tees and 45's in cast iron screwed fittings (½" to 8"), also welded fittings (2" to 8"). The two segments are joined by staples, tape or canvas—and that's all for a clean, neat insulation that fits perfectly. No time is lost, waiting for drying. There's no shrinking, as with cement insulation. And no need to return to point up cracks.

SEND FOR FREE SAMPLE. **Ask your wholesaler for a free sample of the Nicolet Pre-Formed Fitting Insulation, with descriptive pamphlet and price list. Also, for a catalog of the complete line of Sal-Mo asbestos, sponge and wool felt pipe coverings, sheets, blocks and asbestos cements. Or write:**

SALL MOUNTAIN COMPANY

Makers of Fireproofing & Insulating Materials

HAMILTON, OHIO

GET MORE OUT OF YOUR SPRAYING EQUIPMENT WITH LESS POWER

For spraying, washing, rinsing, cooling and air conditioning, Yarway Spray Nozzles will improve the efficiency of your spray equipment.

There are no internal vanes or other restrictions to clog or hinder the flow.

Cast bronze Involute-type

Bar stock Involute-type

Bar stock Fan-spray type

Yarway Spray Nozzles are available in two types—the Yarway Involute producing fine hollow cone spray with minimum energy loss, and the Yarway Fan-spray for flat fan-shaped spray with time-saving slicing action for cleaning.

Wide range of standard sizes and capacities. Made of metal castings or machined from solid bar stock.

The 20-page Yarway Spray Nozzle Bulletin contains not only complete details on Yarway Spray Nozzles and Fittings, but also much helpful information on the many uses for spray nozzles. Ask for a free copy—Bulletin N-617.

YARNALL-WARING COMPANY

107 Mermaid Ave., Philadelphia 18, Pa.

YARWAY / spray nozzles

WHO'S WHAT

The *EMERSON ELECTRIC MFG. CO.* has announced the election of *WILLIAM S. SNEAD* as president and chairman of the board of directors and *JOHN A. DRIY* as executive vice president.

THORN L. MAYES has been appointed general manager of the newly established Small Integral Motor Dept. of *GENERAL ELECTRIC CO.*'s Industrial Power Components Div. The new department will be responsible for standard and derivative lines of polyphase induction motors from 1 to 5 hp. Four staff members of the new department are: *L. DEAN FOWLER*, manager of marketing; *OSCAR L. WEITZMAN*, manager of manufacturing and employee relations; *J. HERBERT BEHM*, manager of engineering; and *MARTIN L. KRESGE*, manager of finance.

TRIANGLE CONDUIT & CABLE CO., INC. has appointed *JAMES D. DALY* as director of sales of the Brass and Copper Tube Div. Mr. Daly was formerly associated with the Graybar Electric Co. as eastern district sales manager.

JIM BLACK has been appointed chief engineer of the *AVERY ENGINEERING CO.* Mr. Black has been with the company since 1939, during which time he was in complete charge of the Dayton office and was most recently at the Cleveland office as a special project engineer.

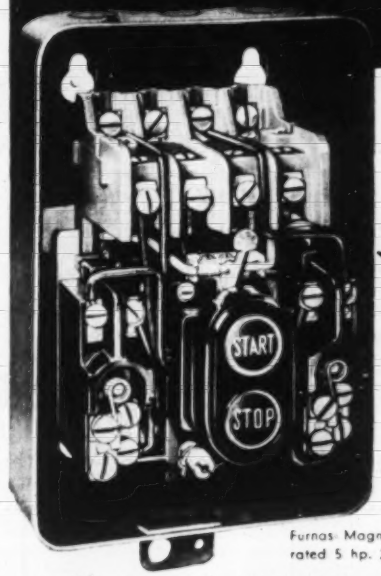
JOSEPH A. GRAZIER has been elected as acting president of the *AMERICAN RADIATOR & STANDARD SANITARY CORP.* This action was taken because of the continued illness of *THEODORE E. MUELLER*, president of the corporation. Mr. Grazier is now executive vice president of the company. He is also a member of the board of directors and its executive committee.

DONALD H. LOUGHRIDGE has been appointed dean of *NORTHWESTERN UNIVERSITY*'s Technological Institute. Mr. Loughridge is a nationally known physicist and the Atomic Energy Commission's assistant director for reactor development. He succeeds *OVID W. ESHBACH*, who is retiring after being dean of the institute since it was established in 1939. Mr. Eshbach will devote his time to teaching.

The *OIL HEAT INSTITUTE* has announced that *CARROLL M. BAUMGARDNER* has been appointed a director in the manufacturer division. Mr. Baumgardner is vice president for sales of the National Radiator Co.

TAYLOR U. COWGER has been appointed sales manager of the Cooling Tower Div. of *HAVENS STRUCTURAL STEEL CO.* Mr. Cowger has been associated with Chrysler Airtemp Sales Corp. for the past six years.

5 Reasons FOR DEMANDING FURNAS MAGNETIC STARTERS



Furnas Magnetic Starter rated 5 hp. 220v; 7½ hp. 550v AC

1 **ARC-QUENCHING SILVER CONTACTS —** Rigidly tested and selected for low contact resistance, best arc-quenching properties.

2 **ARC-RESISTANT TERMINAL BOARD —** Molded of plastic selected for non-tracking properties. . . . *fungus-proof Plaskon alkyd.*

3 **DUAL VOLTAGE COILS —** Furnished in both polyphase and single phase starters. . . . *supplied at no extra cost.*

4 **POSITIVE ACTING THERMAL OVERLOAD UNITS —** of solder-pot type automatically protect motor from overheating.

5 **SHALLOW CASE FOR EASY WIRING —** and good visibility.

Furnas magnetic starters and contactors are available in sizes up to 10 hp. with or without push buttons or selector switch . . . 1041 McKee Street, Batavia, Illinois.

FURNAS

FURNAS *Electric* **MOTOR CONTROLS**

Residential AIR CONDITIONING *Without Water!*

UNICON

by KRAMER

A Remote Type Air-Cooled Condenser that completely eliminates water, sewerage and plumbing problems.

SPECIFICALLY DESIGNED FOR RESIDENTIAL APPLICATION

Unusually Quiet!

WRITE FOR BULLETIN No. U 250

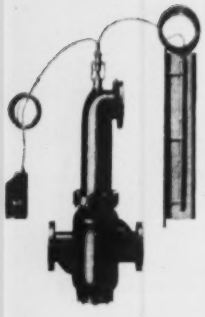
KRAMER TRENTON CO.
Trenton 5, N.J.

York County Home Annex, York, Pa. Architect: Clair S. Buchart, York, Pa. Engineer: William K. Hood, York, Pa. Heating Contractor: C. C. Kottcamp & Son, York, Pa. Floor type Radiant Heating System divided into 13 zones, each controlled by type STA-1 Sarcotherm controls and "Thermoray" comfort thermostats.

ENGINEER-MANUFACTURER
CO-OPERATION
results in perfect comfort

WITH

Sarcotherm
RADIANT HEAT CONTROL



● The heart of the Sarcotherm control system for radiant or forced hot water heating is this unique control valve. It is actuated by liquid expansion thermostats, one located outside the building and one in the valve itself. Between them they anticipate changes in heat loss ratio, thus maintaining comfort temperatures under all conditions.

Here is a striking example of the advantages of close cooperation between the architect's designing engineer and an equipment manufacturer who not only offers complete weather compensated control systems for hot water and radiant heating, but can supplement this with 30 years' experience and the most complete line of accessories for all types of heating.

In the case of York County Home Annex illustrated, engineer William K. Hood, York, Pa., designed a radiant heating system divided into 13 zones, each individually controlled by Sarcotherm.

An important feature of the control system is the unique "Thermoray," a very sensitive heat loss thermostat, influenced by both radiation and convection.

Sarcotherm also regulates supplementary baseboard heating, and unit heaters.

Send us your next problem—there is no obligation. Or write for complete catalogue.

● The Sarcotherm Comfort Control "Thermoray" is an extremely sensitive thermostat affected by both radiation and convection.

22-A

Sarcotherm CONTROLS, INC.
EMPIRE STATE BUILDING · NEW YORK 1, N. Y.

A SARCO PRODUCT

C. A. DUNHAM CO. has named *NORMAN F. SORGENFREI* assistant sales manager. He has been in the heating field for 20 years and during that time has been associated with Maid-O'-Mist, H. A. Thrush & Co. and American Radiator-Standard Sanitary Corp.

Two announcements of changes of personnel for the *COOPER ALLOY FOUNDRY CO.* have been made by the company. *JOHN L. KEATING* has been appointed production manager. He was previously associated with W. W. Slocum & Co. *ANTHONY A. MIANO* has been appointed standards supervisor in the Stainless Engineering & Machine Works Div. He was formerly with Walter Kidde and Co., Pollak Engineering & Mfg. Co. and Resistoflex Corp.

A. E. HESS is now president of the reorganized *D. M. DILLON STEAM BOILER WORKS, INC.* Regular production of all models of boilers will be continued at the company together with stacks, breechings and custom plate work. Some new low pressure models will be added for commercial, industrial and residential applications.

WESTINGHOUSE ELECTRIC CORP. has announced the appointment of four men to key positions in the newly formed Atomic Equipment Dept. *LEO B. DORSNER* is supervisor of manufacturing; *RALPH M. YEARICK* is supervisor of production; *JAMES L. ACKERMAN* is administrator assistant to the department manager; and *BENJAMIN CAMETTI* is manager of the pump engineering section.

I. H. NYE has been elected to the board of directors of *GENERAL CONTROLS CO.* Mr. Nye is treasurer, assistant secretary and controller of the company. *RICHARD G. RAY* has been appointed vice president in charge of manufacturing for the firm. Mr. Ray will retain his position as plant superintendent.

FEDDERS-QUIGAN CORP. has named *W. W. REEVES* division sales manager of the Automotive Div. Mr. Reeves was formerly assistant sales manager. He succeeds *AUGUST IHDE*, who has retired to serve the company as a consultant.

ARTHUR J. RAYMO has been appointed works manager of *FITZGIBBONS BOILER CO.*'s plant at Oswego, N. Y. Mr. Raymo will head all phases of production and plant administration. He was formerly with the Baldwin-Lima-Hamilton Corp. as assistant to the divisional vice president.

RAMSET FASTENERS, INC., Div. of Olin Industries, has appointed *CLARKE TRYON* as sales manager. Mr. Tryon has been responsible for the sales of the firm since its organization in 1947.

JAMES L. MEAGHER has been appointed general manager of the Anchor Div., *STRATTON and TERSTEGGE*. Mr. Meagher was formerly sales manager, *L. J.*

• ARE YOU INTERESTED IN

PERIMETER HEATING?

A-J

This diffusing type floor register was carefully engineered, in cooperation with heating specialists, to provide the answer for a perfect outlet for perimeter heat!

It's ruggedly constructed. The heavy gauge curved vanes are factory-set to deliver a uniform fan-shaped pattern of air to cover the window areas or cold outer walls.

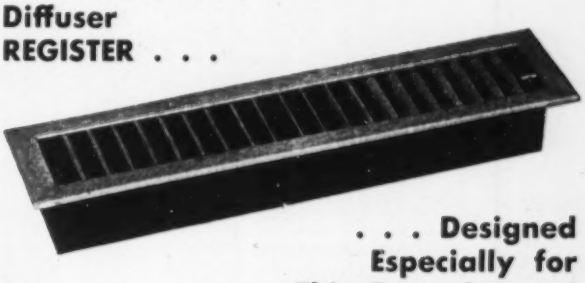
The 4" and 6" widths have multiple louvers. The 2¼" width has a single louver, embossed for greater rigidity. A special lock screw allows you to set the valve louvers so they cannot be opened beyond the desired position after system is balanced. Louvers close tightly to completely shut off air flow when desired.

YOU'LL USE IT MANY PLACES!

The narrow width of this register makes it ideal for numerous installations other than perimeter heating. For instance: In stair risers, under kitchen cabinets, in sills of picture windows. It may also be used as a side wall outlet with high velocity systems. It is VIBRATION-FREE!

Write for our Complete **FREE CATALOG** Listing Over 1000 Types and Sizes of Grilles and Registers for Every Need!

Here's a New Diffuser REGISTER . . .



. . . Designed Especially for This Type System!

AVAILABLE IN SEVEN SIZES!

14 x 2¼	10 x 4	12 x 4	14 x 4
10 x 6	12 x 6	14 x 6	

CHOICE OF FINISHES

A-J Perimeter Registers may be ordered in any of these finishes: Gray prime, Gray Hammertone, Bronze Hammertone, Black Japan, Golden Oak or White Japan.

A-J MFG. CO.

Dept. H7 2119 Washington St.
Kansas City, Mo.

NOW... more heat transfer

from spray deck construction of

Binks noise-free Series 3-B Towers

The spray deck construction of Binks new Series 3-B Mechanical Draft Cooling Towers exposes more water surface to the cooling air. The decks also distribute air evenly throughout the tower. This improves heat transfer and makes the entire tower an *active* cooling region. Result: new high standards in cooling performance.

Noted also for their quiet operation and freedom from maintenance, Binks 3-B Towers are ideal for hospitals, hotels, apartment buildings, private homes, commercial establishments, etc. Capacities available range from 3 to 108 tons.

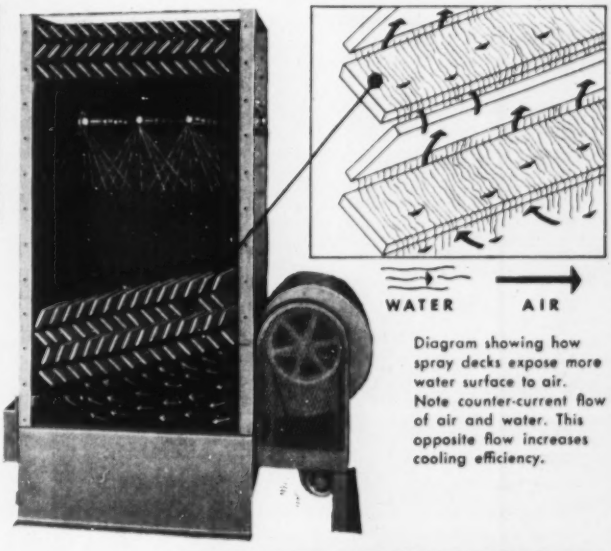


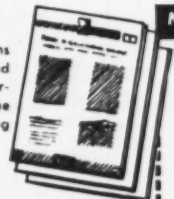
Diagram showing how spray decks expose more water surface to air. Note counter-current flow of air and water. This opposite flow increases cooling efficiency.

Binks
EVERYTHING FOR WATER COOLING

The "inside story"—*FREE*

Send coupon for informative bulletins generously illustrated with pictures and cutaway drawings explaining the operating principles of Binks complete line of natural and mechanical draft cooling towers. Absolutely no obligation.

Binks Manufacturing Company
3118-38 Carroll Ave., Chicago 12, Ill.



Mail coupon today for your FREE Bulletins

Binks Manufacturing Company
3118-38 Carroll Ave., Chicago 12, Ill.

Gentlemen: Please rush me Bulletins on the following towers:
☐ Natural Draft ☐ Blower-Type ☐ Propeller-Fan

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE ____ STATE _____

A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

REPRESENTATIVES IN ALL PRINCIPAL CITIES • SEE YOUR CLASSIFIED PHONE DIRECTORY

COLE

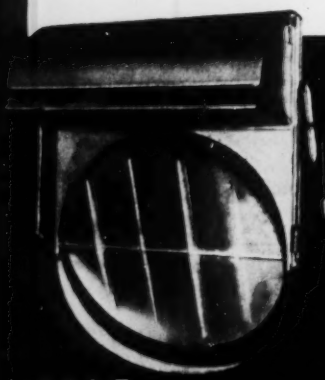
INDUSTRIAL

DRAFT CONTROLS

FOR EVERY NEED — ANY SIZE — ANY SHAPE

Outperform and outlast

ORDINARY CONTROLS



COLE

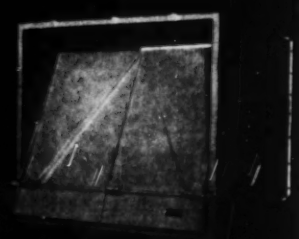
Standard Round Damper Control

Saves 10% to 30% on fuel. Internal damper type. Ball bearing equipped, counterbalanced in all positions. Large-size tuning blades. Top or side mounting. Stock sizes 6" to 36". Special sizes on order.

COLE

Standard Square Gate Control

Open check type. Perfectly counterbalanced. Ball bearing equipped. Stock sizes from 14" to 36". Can be mounted on either side or top of breeching. Special sizes on order.



Exclusive Territories Available for Sales Engineers

COLE-SEWELL ENGINEERING CO.

2288 UNIVERSITY AVENUE • ST. PAUL 14, MINNESOTA

FRANKENBERGER is now production manager for the division. He was previously manager of the Hart Products Div., which has been replaced by the Anchor Div. This new division will manufacture the Hart products.

UNITED STATES RUBBER CO., has announced the appointment of *THOMAS S. SAVOURY* to be in charge of commodity sales, mechanical goods division, for "Uskon" electrical radiant heating panels. Mr. Savoury will continue as manager of mats and other flooring specialties sales. *ROBERT C. CASSIDY* has been appointed "Uskon" merchandise manager.

S. LEONARD SCHWARZ has been appointed superintendent of *DE LAVAL STEAM TURBINE CO's.* North Plant. Mr. Schwarz was formerly assistant superintendent of shop operations.

The *KENNEDY VALVE MFG. CO.* has announced two changes in personnel. *CARL H. MORKEN*, who was formerly works manager, is now vice president in charge of manufacturing. *THOMAS S. TURKINGTON*, who is controller, has been given the additional responsibility of secretary.

HAROLD W. SHIREY has been appointed manager of the Combustioneer Div. of the *STEEL PRODUCTS ENGINEERING CO.* Mr. Shirey was formerly project engineer in radar developments. He succeeds *GEORGES ROUDANEZ*, who has resigned.

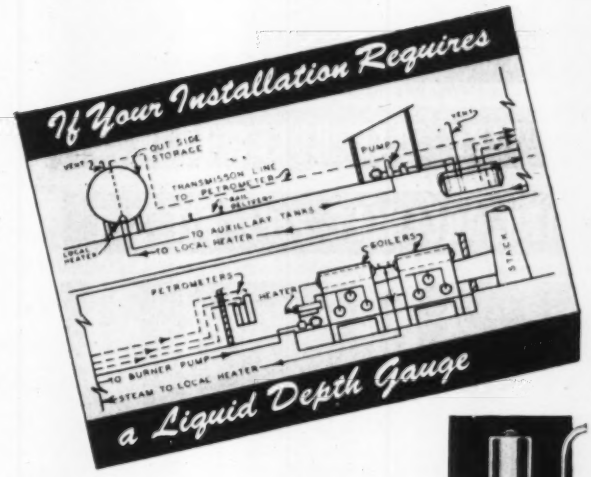
PITTSBURGH CORNING CORP. has appointed *FRANCIS A. YOST* construction engineer. Mr. Yost, who will act as construction consultant with special emphasis on cold storage work, formerly was plant engineer for the Fried and Reineman Packing Co.

ROBERT A. LAWDER of Minneapolis-Honeywell Regulator Co. was elected president of the *NEW YORK SALES MANAGERS CLUB.* Other officers elected were: H. DAVID WARD of Scovill Mfg. Co., vice president; J. WILLIAM JOHNSON of Dennison Mfg. Co., secretary; *G. LLOYD KING* as treasurer, and *M. DESMOND CARLON* of Simplex Paperbox Co., assistant secretary.

KAISER ALUMINUM & CHEMICAL CORP. has announced two appointments. *ARTHUR H. BRANSTAD* is now fabricating plant operations manager and *DAVID MAYERS* succeeds Mr. Branstad as works manager.

L. E. GRUBB has been appointed general superintendent of the Huntington, W. Va. works of the *INTERNATIONAL NICKEL CO., INC. P. H. FLYNN* is now general superintendent of the company's Bayonne, N. J. works, succeeding Mr. Grubb.

SERVEL, INC. has announced the appointment of *PAUL A. METZGER* as materials manager. Mr. Metzger has been with the company for 27 years.



Specify:

PETROMETER

REMOTE READING

TANK GAUGES

THE BEST GAUGE FOR:

Commercial and Industrial Fuel Oil Tanks

Domestic Installations with Buried Tanks

Storage Tanks for other liquids—gasoline, solvents, acids, etc.

Here's Why:

No troublesome moving parts—operates on the sound principle of the U-tube. Simple, dependable and accurate.

Large, easy-to-read vertical scale gives tank contents at a glance. Eliminates the cumbersome measuring stick and the inconvenience of climbing the tank.

Installation is easy—gauges can be installed on tanks above or below ground level and up to ¼ of a mile away. The tank assembly for the gauge can be installed even when the tank contains liquid. It can also be fitted in the tank separately to complete the tank work. The gauge can be connected any time later. Just tighten one simple connection and the job is finished.

FOR TANKS 20 INCHES TO 50 FEET DEEP. *Write for Bulletin PH.*

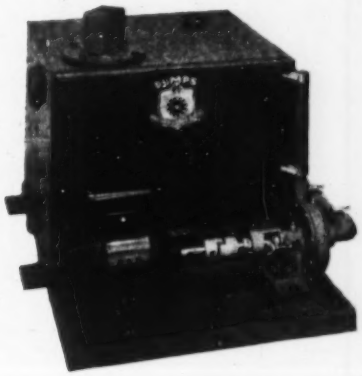
LIQUIDEPTH INDICATORS, INC.

43-22 TENTH ST., LONG ISLAND CITY 1, N. Y.

The New Improved

EAGAN "EAGLE"

CONDENSATE PUMP



MATCH THIS FOR VALUE!

Here's the best condensate pump "buy" on today's market. It provides far more capacity than any similar pump . . . **8,000 sq. ft. EDR at 20 PSI** . . . and it's only (trade price, F.O.B. Phila.) **$124.00**

REDUCED PRICE

Compare These Six Features

IMPROVED DESIGN

- **Low inlet, 2" I.P.S., 12" from floor**
- **All bronze centrifugal pump**
- **Standard ¼ HP 115 volt quiet capacitor motor**
- **Thermal overload protection**
- **Driplip base of heavy structural steel with ½" tapped drain**
- **Flexible connectors on both suction and discharge of pump, and flexible coupling isolate the pump, preventing pipe cramp and misalignment, which cause wear and noise**

OTHER MODELS TO 100,000 SQ. FT. 200 P.S.I.

WALTER H. EAGAN CO., INC.

Mfrs. of Condensate, Vacuum, Turbine, Boiler Feed Centrifugal and Proportioning Pumps
Pump Specialists since 1920

WALTER H. EAGAN CO., Inc. (Dept. B) **MAIL COUPON TODAY**
2336 Fairmount Avenue
Philadelphia 30, Pa.

SEND ME FREE DESCRIPTIVE BULLETIN OF THE NEW EAGAN "EAGLE" CONDENSATE PUMP

NAME .....

COMPANY .....

STREET .....

CITY ..... **Zone** ... **State** .....

Keep TABS on WIRING PERFORMANCE with-

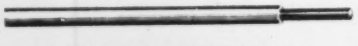
CHESTER
plasticord-plasticote
WIRES & CABLES

Tested and Approved Beyond Specification

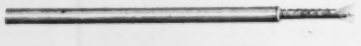
Chester ENGINEERED plastic insulation, laboratory and field tested to more than meet specifications, provides both easier working qualities and longer service life. These rugged plastic coatings offer maximum immunity to abrasion, weather, oil and most chemicals. Smooth and pliable, they pull through conduit easily.

OIL BURNER IGNITION CABLE

THERMOSTAT CABLES



TW BUILDING WIRES



INSTRUMENT WIRE

"Chesty" HAS THE ANSWERS — Plasticord and Plasticote wires are available in standard constructions or custom built to specifications. For a practical solution to unusual insulated wiring problems, call or write.

CHESTER CABLE CORP.
CHESTER, NEW YORK

SPEED AND SIMPLIFY BORING OF PIPE-SIZE HOLES IN WOOD WITH GREENLEE PIPE BIT SET

Designed especially for plumbers, steamfitters and electricians to provide fast, easy boring of accurate holes in wood for ½" to 2" pipe and conduit. Makes swift, easy work of an otherwise tedious, hard job . . . assures clean "tailor made" openings for a neat job. The set is furnished in a sturdy, attractive metal box with convenient carrying handle. Bits have ½" shanks for use in portable electric or pneumatic drills and in stationary boring machines. An adaptor is provided for standard auger bit braces. Adaptors are also furnished for using standard ⅜" pipe as an extension for deeper boring and longer reach. Get facts today on these timesaving GREENLEE tools.

TOOLS FOR CRAFTSMEN
GREENLEE

Greenlee timesaving tools for plumbing and heating work . . . Hydraulic Pipe Benders • Tubing Benders • Hydraulic Pipe Pushers • Pipe Bits • Auger Bits • Spiral Screwdrivers • Chisles and Many More. Write for details. Greenlee Tool Co., 2347 Twelfth Street, Rockford, Illinois.

HENRY ERVIN has been elected vice president-director of sales of *AMERICAN CHAIN & CABLE CO., INC.*, and associate companies. Sales activities of the 16 divisions of the company will be under his direction from his headquarters at 230 Park Ave., New York. Mr. Ervin has been with the firm since 1937 and for the past two years has been administrator, general sales.

HARRY WILLIAMS has also been elected a vice president of the company with headquarters in the Detroit office, 601 Stephenson Bldg. Mr. Williams joined the company in 1927 and has been sales manager of the Automotive and Aircraft Div. in Detroit. He will continue to supervise the sales activities of that division.

At the annual meeting of the *GAS APPLIANCE MANUFACTURERS ASSOCIATION*, *SHELDON COLEMAN* was elected president of the organization. Chairmen of the various divisions, who automatically become members of the board of directors, include: gas water heater division, *H. B. CARBON*, vice president, sales, Bastian-Morley Co., Inc.; gas meter and regulator division, *GILBERT T. BOWMAN*, sales manager of gas products and Nordstrom Valve Divisions, Rockwell Mfg. Co.; gas valve division, *D. E. DuPEROW*, vice president and plant manager, Lincoln Brass Works, Inc.; automatic controls division, *FRANK H. POST*, sales manager, American Thermometer Div., Robertshaw-Fulton Controls Co.; and relief valve division, *GEORGE B. HORNE*, president, Watts Regulator Co.

Also elected were chairmen of groups. They include: gas boiler group, *A. F. WESTERFIELD*, vice president, U. S. Radiator Corp.; gas furnace group, *HERBERT G. HAYES*, chief engineer, Armstrong Furnace Co.; unit heater group, *D. R. WEBSTER*, president, Reznor Mfg. Co.; and gas conversion burner group, *HARRY GURNEY* of Surface Combustion Corp.

Directors of *STEWART-WARNER CORP.* have re-elected all incumbent corporation officers at the first board meeting held subsequent to the annual meeting of the stockholders. Six new vice presidencies were also created and filled at this meeting.

CARL J. WINKLER, general manager of the U. S. Machine Div. of the firm, was one of the vice presidents elected.

DAVID MacGREGOR, who is now chief engineer of *EDWARD VALVES, INC.*, has also been appointed as works manager of the East Chicago company. In his new position Mr. MacGregor will supervise all manufacturing operations and industrial relations. He has been with the firm since 1925.

At the annual meeting of the *NATIONAL ASSOCIATION OF FAN MANUFACTURERS, INC.* the following officers were elected for the ensuing year: *J. M. BIRKENSTOCK*, president; *R. A. WASSON*, vice president, and *L. O. MONROE*, secretary-treasurer.

HOWARD W. JAMES has been appointed advertising and sales promotion manager of the *FLEXIBLE TUBING*

Showing how

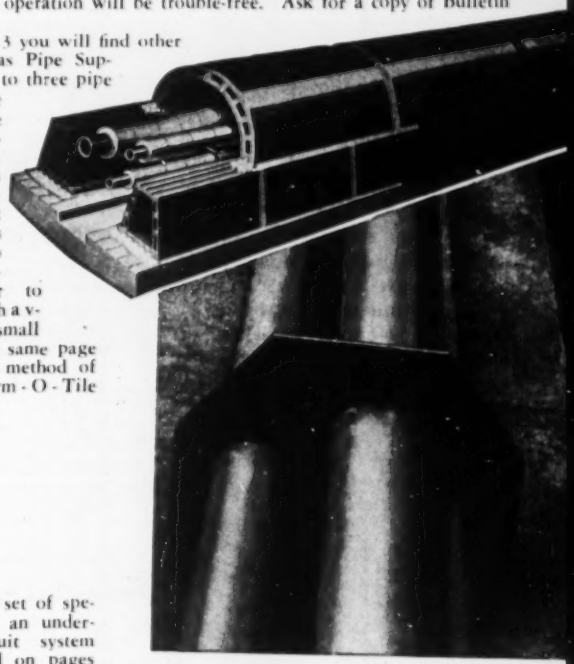
Therm-O-Tile

REG. U.S. PAT. OFF.

Underground Steam Conduit is Guided and Anchored

In Therm-O-Tile Bulletin No. 511, page 7, you will find a Typical Plot Plan showing the arrangement of Therm-O-Tile Conduit Lines between buildings with the location of anchors, guides, and expansion loops. There are six buildings in the group, including the boiler house. Elevations show the strategy involved in properly locating the boiler house so that operation will be trouble-free. Ask for a copy of Bulletin 511.

On page 3 you will find other details such as Pipe Supports for one to three pipe lines, and the Pipe Saddle which is sometimes wanted. Page 4 shows our U-Tile type conduit which is adaptable to one-pipe installations or to installations having several small pipes. On the same page is shown the method of making Therm-O-Tile Arch Tiles.



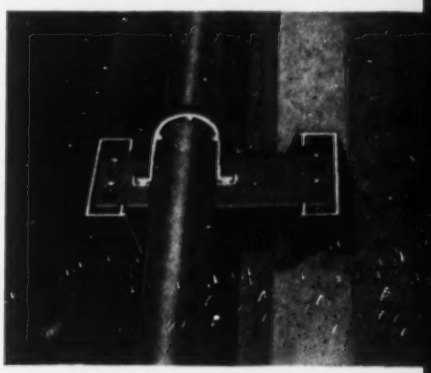
A Typical Therm-O-Tile Guide Plate for Directional Control of Expansion and Contraction.

A complete set of specifications for an underground conduit system will be found on pages 6 and 7.

And so on. If you are interested in underground conduits — if you are contemplating the installation of such a conduit — be sure to ask for and study Bulletin 511. It makes clear the many advantages possessed by Therm-O-Tile. Also remember that Porter-Hayden engineers will be happy to aid in ironing out details.

JOHNS - MANVILLE.

Sold and installed by Johns-Manville Technical Service Units in all Principal Cities.



Typical Therm-O-Tile Anchor Construction. Any Expansion Thrust is Firmly Held by the Rigid Concrete Base.

H. W. PORTER & CO., INC.

822-H Frelinghuysen Avenue • Newark 5, N. J.

REID HAYDEN, INC.

BALTIMORE, MD. RICHMOND, VA. CHARLOTTE, N. C.

Insulation Engineers & Contractors

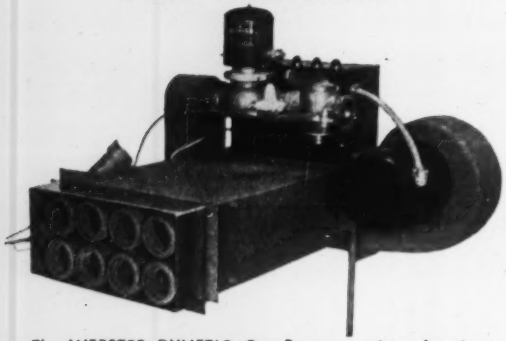
WEBSTER DUONETIC*
for Dual Fuel Firing

The WEBSTER DUONETIC* now offers unsurpassed economy, efficiency and trouble-free operation in the combination oil and gas firing equipment field. Never before have both fuels been burned so well so simply.

You can rely on the usual WEBSTER quality to provide you with the best.

Both burners employ electric ignition; constant electric ignition on the oil burner, and electric ignition for the gas burner safety pilot.

WEBSTER DYNETIC*
Forced Draft
GAS BURNER



The WEBSTER DYNETIC Gas Burner consists of multiple venturi tubes with heat resistant alloy, flame retention nozzles assembled in a metal housing and equipped with an electrically driven blower to furnish all of the air for combustion.

All of the valves and controls required for safe, automatic operation, except for thermostat and limit controls, are incorporated in the assembly and wired and tested at the factory. The motor driving the blower is equipped with a centrifugal switch to prevent main gas valve operation unless the blower is functioning.

The burner is now available in 13 sizes for natural gas up to and including 300 h.p.

*TRADEMARK

The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

CORP. Mr. James will also head the company's distributor sales training program. He was previously general manager in charge of advertising and sales promotion for Ken Paulson Assoc.

EVERTT GARRETT has been appointed plant superintendent of the Kitson Valve Div. of the *WELSBACH CORP.* He was formerly general foreman and has been with the company since 1940.

Kaiser Engineers Div. of *HENRY J. KAISER CO.* has announced the appointment of *MIKE MILLER* to be in charge of all activities connected with joint-venture work of the firm. Mr. Miller has been with the company since 1931 and during that time has been located in various parts of the United States managing construction work for the firm.

F. L. WHITNEY has been appointed chief engineer of the *WALTER KIDDE CONSTRUCTORS, INC.* Mr. Whitney recently was honored by the Museum of Modern Art as designer of the Corn Products Refining Co.'s Bluebonnet plant at Corpus Christi, Texas.

JEROME A. CLARKE has been appointed head of *AIR-TEMP DIV.* sales training department at the Dayton home office of *CHRYSLER CORP.* He was formerly in charge of the Detroit regional sales office and has been with the company since 1940.

UNITED STATES RADIATOR CORP. has announced the election of *E. M. SWARTZ* as vice president of the firm. Mr. Swartz will be responsible for supervision of manufacturing for the company's steel division. He has been with the company since 1935.

BRODERICK HASKELL has been elected vice chairman of *COMBUSTION ENGINEERING, INC.* Mr. Haskell has been a member of the board of directors and the executive committee of the company for the past 10 years, and recently resigned as a vice president of the Guaranty Trust Co. of New York to accept this new position.

AIR REDUCTION SALES CO. has announced the appointment of *E. C. CLARK* as director of operations. Mr. Clark has been with the company for 24 years and during this time has held various positions including superintendent of Houston and Louisville oxygen plants. His most recent position was assistant director of the research and engineering department for the firm.

W. F. CAROLAN of the Radio Corp. of America has been elected chairman of the Room Air Conditioning Section of the *AIR CONDITIONING AND REFRIGERATION INSTITUTE.* He succeeds *H. L. LAUBE* of the Remington Air Conditioning Div. *A. E. MELING,* Carrier Corp., was elected vice chairman.

ISHIER JACOBSON has been appointed manager of the Export Div., *CONNOR ENGINEERING CORP.*

*and naturally they're using

STANDARD'S NEW

Perimeter Floor Register

with Standard's exclusive

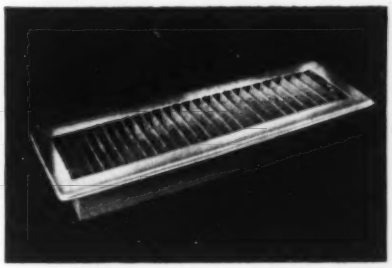
DIALAMATIC CONTROL

*This is it!

Model No. PH-142

Works Better

Made Stronger



SPECIFICATIONS

The face and blades of model PH-142 are fabricated of 16 gauge steel, the blades are set in a fixed-fan angle degree for even deflection. The frame is of one piece, 18 gauge steel construction. The Louvre box fabricated of 16 gauge steel. Packed one to a box, and 20 to a master carton. Comes handsomely finished in gleaming, durable metallic-lustre. 4 sizes available.

For more information and Standard's New Pocket Catalog, attach this coupon to your business letterhead and mail to:

Standard Stamping & Perforating Co.

3151 WEST 49TH PLACE · CHICAGO 32, ILL.

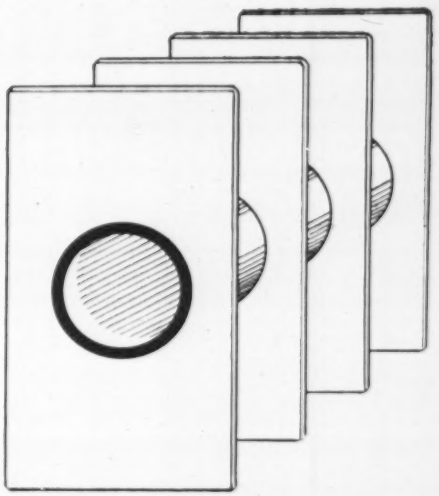
PRESSURE TUBING

makes AUTORAD more efficient

AUTORAD finned radiation is definitely more efficient than conventional radiation because AUTORAD forms fins on pipe-size *pressure tubing* instead of on pipe. For maximum heat transfer the tubing must be precisely *uniform in diameter* and — what's more important — must be *perfectly round*.

Pressure tubing costs more than pipe but the *extra* efficiency you get from AUTORAD is worth far more than the extra cost in manufacture. If you want the *best* in finned radiation, specify AUTORAD — always.

Ask for complete data



AUTORAD finned radiation includes factory-dimensioned finned tubing and attractive enclosures. Easy to install; completely satisfactory to both contractor and owner.

AUTO-RAD Inc.

Manufacturers of Heat Transfer Equipment Since 1920

3535 W. Fillmore St., Chicago 24, Ill.

JOHN McCARDLE has been appointed market manager of gas controls of *MINNEAPOLIS-HONEYWELL REGULATOR CO.* He was formerly manager of the Dayton sales office and is being succeeded by *EARL HOEFLER*, who is rejoining the company after two years' service with the Navy. Mr. McCardle will be at the Minneapolis headquarters.

MINNEAPOLIS-HONEYWELL REGULATOR CO. has announced the promotion of *KARL SCHICK* to sales manager of the Original Equipment Div. He will direct sales of all types of home heating controls to original equipment manufacturers. He had been sales manager of the company's gas controls division since 1949.

DAVID W. JASPER, JR. has been appointed general attorney and head of the legal department of *CARRIER CORP.* He is a member of the Anti-Trust Law Section of the American Bar Association. *HERMAN SEID*, who has been serving as an independent legal counsel, will continue as secretary of the corporation but with special emphasis upon patents, trade marks and international business.

IN THE TERRITORIES . . .

For *CENTURY ENGINEERING CORP.* — A new wholesale distributor for the Detroit area is the *GEORGE L. JOHNSTON CO. JACK M. BARAGER* is general manager, *E. A. CUNEO* is manager of heating and air conditioning sales, and *GEORGE L. JOHNSTON* is president. The company was formerly known as the Johnston Refrigeration Co.

For *ALLIS-CHALMERS MFG. CO.* — A distributor for pumps is the *TRI-STATE AIR CONDITIONING DIV.* of *R. H. KYLE & CO.* It will serve several counties in southern Ohio, Kentucky, West Virginia and Virginia.

For *MIDWEST SUPPLY CO.* — *LOUIS H. NIEBLING* is manager of the Chicago district sales office. He was formerly director of controlled materials in the St. Louis office. *WALTER JANESCH* is assistant to Mr. Niebling in the Chicago office.

For *BARNES & JONES, INC.* — Several new representatives have been appointed: The *WILLIAMS ENGINEERING CO.*, Milwaukee, Wis.; *PHILIP R. REESE, INC.*, Minneapolis, Minn.; *LESTER J. NADEN*, Albany, N. Y.; *K ENGINEERING CO.*, Omaha, Nebr.; *THOMPSON & HELIKSON*, Chicago, and *E. F. GREGG*, Philadelphia.

For the *NATIONAL RADIATOR CO.* — *URQUHART-SHEAHAN CO.* has been appointed sales agent in Montana, northern Idaho, Oregon and eastern Washington. The new agent will market the firm's boilers, radiators, convectors, unit heaters, baseboard radiation and other heating products.

GET NON-CLOG PERFORMANCE—AT MODERATE PRICES with AMERICAN-MARSH SEWAGE AND SUMP PUMPS

WRITE FOR YOUR COPY OF THIS NEW BULLETIN

In this brand-new bulletin, you'll find full data on the high efficiency—and non-clog design—of American-Marsh Sewage and Sump Pumps. Despite many superior construction features, they're competitively priced.

Described in detail are three non-clog types—the NKS Vertical, Wet Pit Single or Duplex; the NKV Vertical, Dry Pit; and the NKH Horizontal.

When you look at the performance tables and examine the construction drawings, you'll see why these top-quality sewage and sump pumps can deliver the trouble-free service you want.

A "pump selection" page will help you choose the model you need . . . and our engineering staff will gladly cooperate too. *INVESTIGATE NOW—WRITE FOR NON-CLOG BULLETIN 325-A.*

AMERICAN-MARSH PUMPS

BATTLE CREEK MICHIGAN

In Canada:

American-Marsh Pumps (Canada) Ltd., Stratford, Ont.

CENTRIFUGAL, TURBINE, STEAM AND POWER PUMPS FOR TESTING, PROCESSING, BOILER FEED, FIRE PROTECTION, ETC.

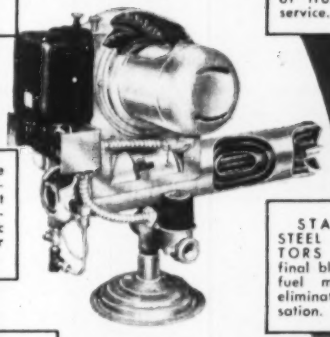
The "Inside Story" of SIEMON Power-Flame SUPERIORITY

Power-Flame units (all models) are shipped completely assembled with controls wired. Just connect power and gas lines.

Quiet, amply-sized blowers provide balanced air mixture for very high heating plant efficiency.

Controls burner mounted and tested. Installation cost reduced to a minimum.

Motors amply-sized and properly applied bring to Siemon users a lifetime of trouble-free service.



Lighting made easy. Push button runner pilot on smaller capacities. Electric ignition on larger models.

STAINLESS STEEL DEFLECTORS provide final blending of fuel mixture — eliminating pulsation.

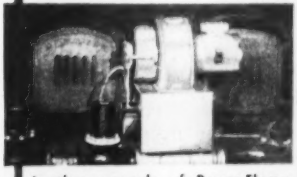
Balanced air adjustment. Precision built to provide metered air for complete combustion.

"Tube within a Tube" design. A Siemon exclusive means quietness and very high efficiency.

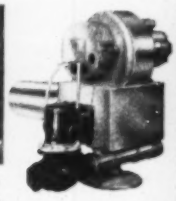
The GAS Conversion Burner

Engineered for "Hard to Fire" Applications

Forced-draft design reduces to a minimum the problem of natural drafts. Perfect intermixing of air and gas results in real fuel saving. Highly efficient in down-draft heating plants. Gun-type design permits installation in a minimum of space.



Another example of Power-Flame versatility. This installation made over a coal stoker.



Models in capacities from 85,000 to 3,000,000 B T U input. All units are completely packaged and gun-type design. installation costs reduced to a minimum.

You owe it to yourself to get the facts about Siemon's "profit plan." Write today for literature and information about Power-Flame Gas Conversion Burners.

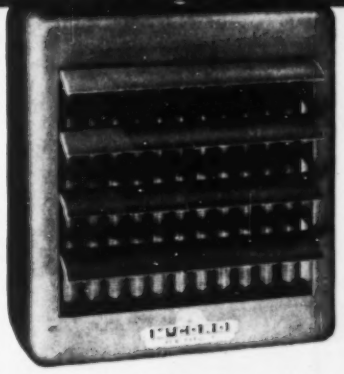
Siemon Power-Flame BURNER

Siemon Manufacturing Co.
1819 Holmes
Kansas City, Missouri

McCORD

HEATING AND AIR CONDITIONING PRODUCTS

HORIZONTAL TYPE UNIT HEATERS



Modern design—top performance—thousands in use—dependable heat. All copper coils to resist corrosion — individual tube expansion — most rugged construction — quiet operation — easy installation—standard motors with standard bases. Sizes to 272,000 B.T.U. capacity.

VERTICAL TYPE UNIT HEATERS

A proven heating unit—all copper coils to resist corrosion. McCord spiral tube fin construction creates air turbulence without undue restriction. Improved fan delivers large volume of air, with minimum air noise. All McCord heaters are guaranteed for use with 150 lbs. saturated steam pressure. Sizes to 575,000 B.T.U. capacity.

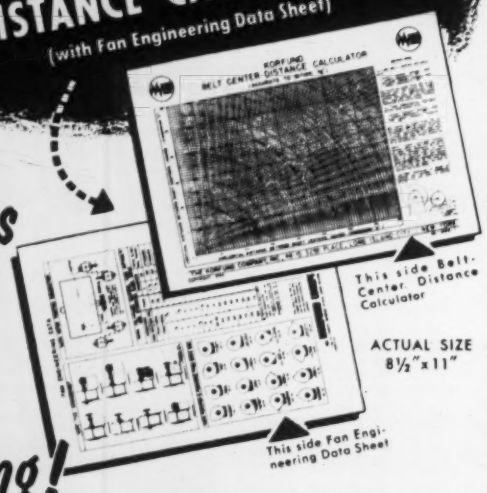
McCORD CORPORATION
DETROIT 11, MICH.

A Real Time Saver—

THE KORFUND BELT-CENTER DISTANCE CALCULATOR

(with Fan Engineering Data Sheet)

is yours for the asking!



ACCURATE TO 1/8", the handy Belt-Center Distance Calculator, another Korfund first, replaces the lengthy calculations previously needed when selecting fan and compressor belts and checking equipment clearances. Does in seconds what formerly took several minutes . . . and it's yours for the asking.

The reverse side of the calculator is a Fan Engineering Data Sheet. NAFM and NEMA Data which heretofore was obtainable only by searching through Handbooks is now at your fingertips.

We know you'll want to have this Calculator and Data Sheet, so ask your nearest Korfund representative for your copy, or fill out and mail the coupon *now*, before you forget — or our supply becomes exhausted.

Remember, your Korfund representative has a wealth of information telling how you can economically STOP VIBRATION with Korfund Vibration Control and reap the many benefits that vibration-free operation of your air conditioning equipment can bring.

THE KORFUND CO., INC.

KORFUND — SPRING — RUBBER — CORK

48-01F Thirty Second Place, Long Island City 1, N. Y.
In Canada: 510 Canal Bank, Ville St. Pierre, Montreal

Please send me the Korfund Belt-Center Distance Calculator

NAME_____

POSITION_____

COMPANY_____

STREET ADDRESS_____

CITY_____ STATE_____

Mail to: The Korfund Co., Inc.,
48-01F Thirty-Second Place, Long Island City 1, N. Y.

For the *BRISTOL CO.* — *SAM E. GEWIN* has been appointed district manager of the St. Louis office. Mr. Gewin, who has been with the firm since 1937, has been resident sales engineer in the Buffalo area for the past 5 years. The new headquarters are in the Cotton Belt Bldg.

For *CHASE BRASS & COPPER CO.* — *ROY W. SIDBURY* has been appointed district manager of the Baltimore branch. *ARTHUR F. MILLER*, Baltimore district manager since 1918, will remain as a consultant until his retirement in September. Mr. Sidbury has been with the company since 1936.

For *McQUAY INC.* — Several new appointments: *AUTOMATIC HEATING AND COOLING SUPPLY CO., DIV. OF WEIL-McLAIN CO.*, is now an authorized distributor for refrigeration products in the greater Chicago area; *TENNITY & SERFASS* has been appointed in the Los Angeles area. *GEORGE D. SERFASS* is now a partner of *WILLIAM TENNITY*, and *LLOYD BACKSTROM* is the new refrigeration products sales representative in the Pacific northwest territory.

For *RAMSET DIV.* of *OLIN INDUSTRIES, INC.* — *JASON H. RADDING* is merchandising manager for the New York City metropolitan district. Mr. Radding will maintain his office at 655 Madison Ave.

Manufacturers' Agents

Are you interested in securing additional lines?

We are occasionally asked by our manufacturer advertisers to suggest the names of manufacturers' agents in various sections of the country whom they can contact in regard to representation of their industrial large building heating, piping and air conditioning products.

If you would like your name listed on our records for inquiries we may receive for your territory, we invite you to write us. There is no charge in connection with this service.

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"CORRECT PRACTICE in INDUSTRIAL PIPING"

— All-New Second Edition —

196 Pages — 8½" x 11" — $1.50

This practical book is made up of outstanding papers and data on industrial piping selected from past issues of "Heating, Piping & Air Conditioning." It is a most comprehensive collection of case studies, showing how various difficult piping problems encountered in different industrial plants were successfully worked out by piping experts.

Design, installation, operation, and maintenance . . . steam, air, gas, oil, process, water and refrigeration piping . . . piping in pulp and paper and steel mills, in automobile plants and breweries, in the food and chemical and textile industries, and in many other types of manufacturing plants are dealt with from many different angles.

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SCHOOLS • COLLEGES
HOSPITALS • OFFICE
AND PUBLIC BUILDINGS
assure

safe, dependable air distribution
with

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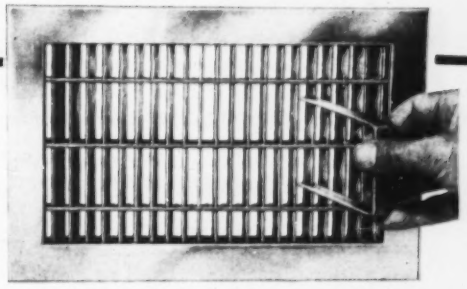


R & G Style 120, Chromium plated, Solid Bars with Interlocking Cross Bars (fixed or adjustable).

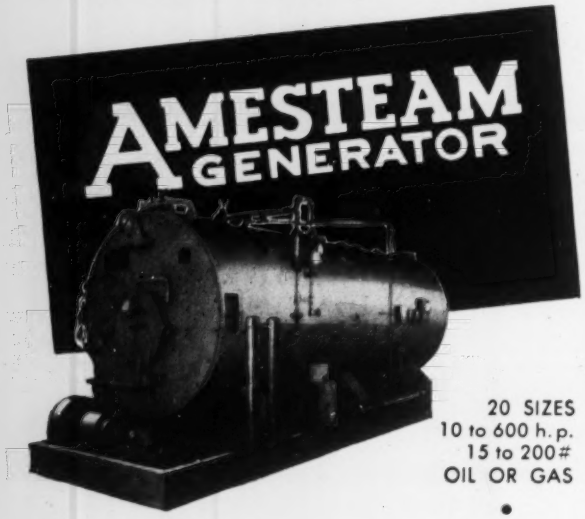
***FAULTLESS OPERATION**
***RUGGED CONSTRUCTION**

Complete Line of Registers and Grilles for HEATING • VENTILATING • AIR CONDITIONING
Catalog on Request

REGISTER & GRILLE MFG. CO., INC.
70 BERRY STREET, BROOKLYN 11, N. Y.

REAL SAVINGS

in installation . . . in operation with these "PACKAGED" BOILERS



20 SIZES
10 to 600 h.p.
15 to 200#
OIL OR GAS

JUST SET IT ON YOUR CONCRETE FLOOR — no special foundation or heavy stack are needed. You make BIG savings on installation of AMESTEAM GENERATOR because it's a complete, self-contained unit, ready to start generating steam!

FULLY AUTOMATIC . . . TROUBLE-FREE! Set it and forget it. No more continual dirt, dust and ashes. Models for oil or for gas, or combination units for either fuel.

EASY TO CLEAN! EASY TO GET AT! Davit-hinged doors at rear give quick access to furnace and all tubes — and look at the space under the shell!

COMPLETE SERVICE! Our LOCAL service man starts your unit and gives you three months' FREE service.

Write for FREE bulletin TODAY!

AMES IRON WORKS
Box D-73, Oswego, N.Y.

Gentlemen:
Please send me further information on AMESTEAM GENERATORS and name of nearest representative.

NAME .....
COMPANY .....
ADDRESS .....

AMES IRON WORKS INC.

BOX D-73 **OSWEGO, N. Y.**

For *UNITED STATES AIR CONDITIONING CORP. — LAMSON & ASSOC.*, has been appointed sales representative for window type room coolers in eastern Tennessee, Georgia and Florida. *JOHN V. BILLS* has been appointed as sales engineer and air conditioning design assistant for *REUBE O. EMERY*, who is representative at the field office of the firm located in Nashville, Tenn.

For *FARR CO.* — Several new sales representatives: *AIR FILTER SALES & SERVICE CO.*, Jackson, Miss. and *AIR FILTER SALES & SERVICE CO.*, Nashville, Tenn. are representatives in their respective areas; *MARSHALL, NEIL & PAULEY, INC.*, Texas and Louisiana representatives, have organized a subsidiary company in New Orleans, the *AIR FILTER CO.*, to handle sales and service in that area. Four other representatives named are: *ST. LOUIS AIR FILTER SALES & SERVICE CO.; AIR FILTER SALES & SERVICE-DENVER; AIR FILTER SALES & SERVICE-MINNESOTA* in Minneapolis, and *DUST CONTROL, INC.* who will represent the Farr Co. in Hawthorne and San Diego, Calif.

For *SERVEL, INC.* — A new distributor. *STATE DISTRIBUTING CO.* will handle products in the Wisconsin and upper Michigan area. *FORREST F. LANE* is the general manager of the new distributor.

For *ACME INDUSTRIES, INC.* — *R. E. CHASE CO.*, 3232 E. 11th St., Tacoma, Wash., is direct factory repre-

THE NEW
DISTRICT HEATING
HANDBOOK
THIRD EDITION

An Entirely New Volume — 529 Pages
15 CHAPTERS — 6"x9¼"

GROWTH AND PRESENT STATUS
ECONOMICS OF DISTRICT HEATING
GENERAL DATA
DISTRICT HEATING PLANTS
WATER CHEMISTRY AND CORROSION
STEAM DISTRIBUTION
METERING
BUILDING HEATING SYSTEMS
CONSUMERS' PROCESS EQUIPMENT
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HOT WATER FOR DISTRICT HEATING

Price $7.00

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827 N. EUCLID AVE., PITTSBURGH 6, PA.

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HEATERS SINCE 1918

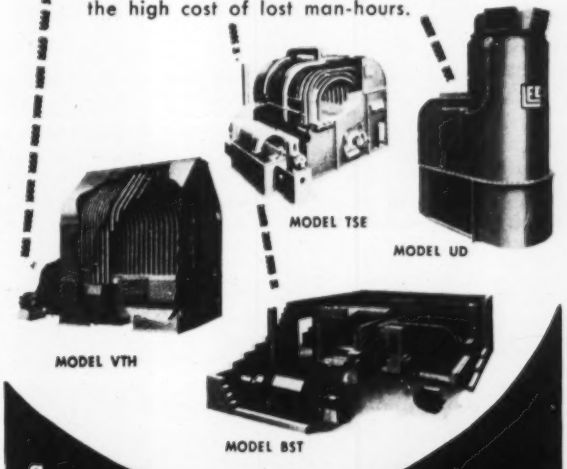
direct-fired heaters for industry to help

INCREASE EFFICIENCY and PROFIT

brings comfort to workers . . . reduces absenteeism

Uneven temperatures cause discomfort, sickness, disgruntled workers, lower efficiency, reduced work output and especially absenteeism.

Winter and summer, you can depend on Lee completely engineered heaters to efficiently keep your plant at even-temperatures with balanced air. Avoid drafty, turbulent air carrying-dirt and dust, causing work spoilage, damaged products and the high cost of lost man-hours.



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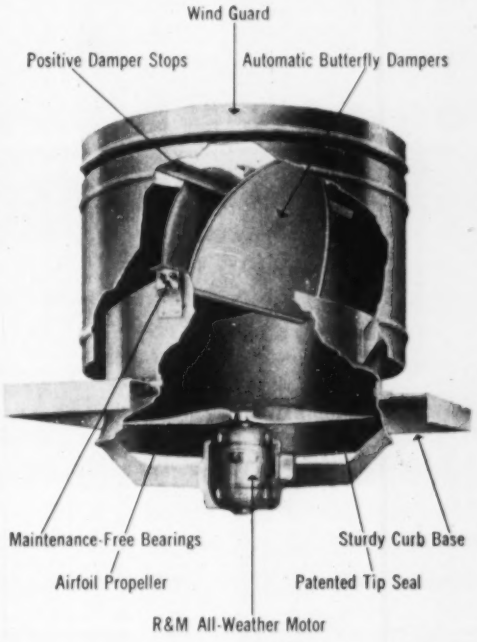
HEATERS SINCE 1918

SKY-BLAST®

The Modern Power Roof Ventilator



Most economical way to expel heat, fumes, smoke

This modern power roof ventilator is backed by 20 years of research and engineering.

Famed airfoil propeller, powered by the *All-Weather* Robbins & Myers motor, sweeps up heat, moisture, dust, fumes—then *blasts them high into the outside air.* Wind guard and throat design assure constant performance regardless of wind.

Automatic butterfly dampers open wide on minimum fan pressure for guide vane effect and virtually unrestricted air flow. Galvanized roof over damper shaft and bearing supports provides rainshed when fan is not operating. Easily mounted on any type roof, Sky-Blast provides air deliveries up to 78,800 CFM. Low silhouette cuts down roof stresses. Our engineers will be glad to give you free advice on any ventilating problem.

Write for Catalog 680-H.

PROPELLAIR®
DIVISION OF ROBBINS & MYERS, INC
SPRINGFIELD · OHIO

Man Cooler | Direct Drive | Tubeaxial | Vaneaxial | Extended Shaft

YOU CAN SEE THE DIFFERENCE!

THE DIFFERENCE between a Taylor BINOC* Industrial Thermometer and one with conventional tubing is visible at a glance. You can see the mercury from as far as you can read the scale—and through an unusually wide angle. There is no confusing bore reflection either, thanks to BINOC tubing. Result: you read it more easily, more frequently. Send for **Catalog 5.** Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

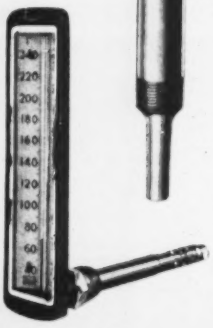
*Reg. U. S. Pat. Off.

For General Testing. An etched stem glass thermometer, complete with metal carrying case. Specially selected and properly annealed glass. Calibrated at close intervals with accurate spacing of graduations. Length 5½". 2° divisions.

- **21410,** minus 30° to +120° F., mercury filled, **$1.80**
- **21412,** minus 50° to +120° F., red liquid filled, **$1.80**
- **21418,** 0 to 220° F., mercury filled, **$2.10**

For Brine and Ammonia Lines. Stem lengths (total stem) $6^{1}/_{16}$" or $8^{1}/_{16}$", with 7" or 9" scale. Your choice of straight or 90° angle stem. Separable socket connection. Insulated stem. Brass for brine service, steel for ammonia. Range minus 40° to +110° F.

Catalog # 11E5358 shown
$29.40



For Air Ducts, Dry Kilns, etc. 6" to 24" stem lengths. With 7" or 9" scales. Available with straight or 90° angle stems. Union connection. Super-sensitive type bulb. Range 0 to 160° F.

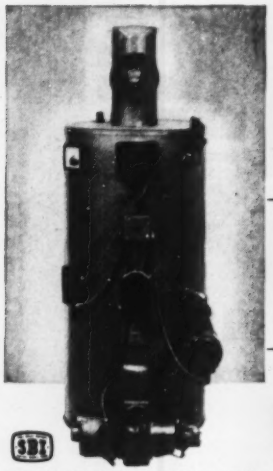
Catalog # 12EU349 shown
$26.60

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

TAYLOR INSTRUMENTS MEAN ACCURACY FIRST

GET ALDRICH *Gulf Stream*

C-SERIES BOILER-BURNERS



SBI

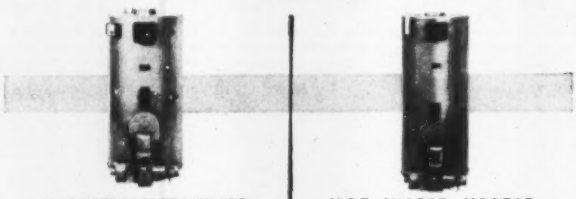
GULF STREAM PACKAGE. Fully erected, pre-wired, accessory-equipped package. Ready to set in place and connect.

P **PERFORMANCE** – With Lasting Economy. Fast, quiet hot water heating . . . instant hot water.

D **DESIGN** – For Today's Market. Quick and easy to install, Aldrich saves money, space, installation time.

Q **QUALITY** – At Quantity Prices. Engineered for instant response to heating needs . . . peak fuel efficiency.

EASIER TO SELL . . .
EASIER TO INSTALL . . .
EASIER TO SERVICE . . .



GULF STREAM STANDARD
Shipped fully erected with complete automatic controls: stack switch, thermostat and limit control.

HOT WATER HEATER
Internally galvanized; 100 to 255 GPH at 100° rise. Instant, directly heated hot water.

ALDRICH *Gulf Stream* OFFERS VALUE . . .

that's profitable to sell, practical to buy.

- **Five sizes with SBI ratings from 440 to 1120 square feet of water radiation.**
- **Multiple flue tubes baffled for maximum heat extraction.**
- **Aldrich burners coordinated to Gulf Stream boilers.**
- **For inspection and maintenance, readily removable top jacket and large opening to combustion chamber.**
- **Minimum temperature change regardless of firing conditions.**
- **Designed for standardized production; to meet ASME code.**
- **Burners U.L. listed.**

ANOTHER BREEZE MARK PRODUCT

THE ALDRICH COMPANY

105 East Williams St., Wyoming, Illinois
A Subsidiary of Breeze Corporations, Inc.

sentative and sales engineer in the Northwest for the states of Washington, Oregon, western Montana and northern Idaho. Branch offices of the Chase Co. are located in Seattle, Spokane, and Portland, Ore.

For *WELSBACH CORP.*, Kitson Valve Div. — *JAFFE SALES CO.* is the new representative in the Chicago-Milwaukee areas. This company will deal with heating, plumbing and industrial wholesalers. *ADOLPH JAFFE* is associated with his son, *JACK A. JAFFE* at 7709 S. Yates Ave. in the Chicago office. *HERBERT SCHROEDER* is manager of the Milwaukee office located at 312 E. Wisconsin Ave.

For *WORTHINGTON CORP.* — *RALPH G. GRIFFIN* has been appointed assistant manager of the Cincinnati district office. Mr. Griffin has been associated with the company since 1930.

For *DE LAVAL TURBINE PACIFIC CO.* — Two new district sales managers. *J. ALLAN GREENLAND* will handle the San Francisco office and *DONALD T. BIXBY* will be at the Seattle office. Mr. Greenland has been with the company since 1938 and was most recently sales manager of the Seattle office.

For *AIRTEMP DIV., CHRYSLER CORP.* — *F. G. HILL* has been appointed Kansas City regional manager. Mr. Hill was a district manager in the Kansas City sales office for the past three years. He replaces *T. U. COWGER*, who resigned.

For *ORR & SEMBOWER, INC.* — A new sales office at 51 E. 42nd St., New York. *JARED DARLINGTON III* is district manager. The new office will handle field sales activities in the metropolitan area including Westchester county, Long Island, and northern New Jersey.

C. A. BREED, INC., 1089 Washington St., West Newton, Mass., will be the sales and service representative for packaged automatic boilers in the Boston area.

For *MINNEAPOLIS-HONEYWELL REGULATOR CO.* — *STEPHEN M. RAMSEY* has been appointed manager of the Columbus, Ohio, sales office. Mr. Ramsey has been with the company since 1949. The office is responsible for sales in 14 counties surrounding the Columbus area.

For *HAJOCA CORP.* — *JOHN P. TRIMBLE* has been appointed representative of the new sales office at Pittsburgh. The corporation will soon offer a complete line of refrigeration and air conditioning equipment through a new department opened at the Savannah, Ga., branch office. *W. W. WILSON*, who was formerly in the refrigeration division at the Jacksonville branch, will be territory salesman, and *MILTON PAPPAS* will handle sales at the branch office.

For the *BABCOCK & WILCOX CO.* — A new engineering office to be located in Florida, in addition to the two

greater efficiency for

Commercial and Industrial

GAS

fired heating plants with

field

"M-G" draft controls

1. Double acting gate opens inward to regulate up-drafts and outward to relieve down-drafts.
2. Adding or taking off weights provide simple adjustment for up-draft conditions at time of installation.
3. Control will relieve internal or down-draft pressures of only a few thousandths of an inch.
4. Weights attached to gate itself are factory set to insure extreme sensitivity to down-draft conditions.
5. Corrosion resistant knife edge bearings resting on self-aligning bearing plates assure extreme sensitivity yet long life.
6. Side wings improve the regulation, making the control accurate at all gate positions.
7. Long collar keeps gate out of the path of flue gases—resulting in greatly increased life.

Now there is a Field Draft Control to provide for commercial gas-fired heating plants the same accurate, dependable, fuel-saving performance that has made Field first choice for oil and coal furnaces. The new Field "M-G" for gas is fully proven, widely accepted, fully safe — a control specially designed for gas but retaining all outstanding design features of the Field Type M Control. Write today for complete information.

FIELD CONTROL DIVISION

of H. D. Conkey & Company — Mendota, Illinois

AFFILIATES: Conco Building Products, Inc. — Brick, Tile, Stone
Conco Materials Handling Division, — Cranes, Hoists

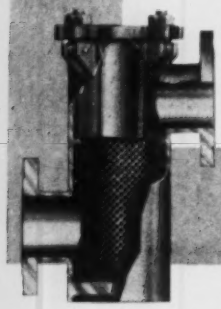
UP-DRAFT VIEW

Gate opens inward to regulate updrafts in conventional, proven manner, checking any excess in draft.

DOWN-DRAFT VIEW

Gate opens outward to relieve down drafts which might affect flame. An optional safety switch closes main gas valve in case of prolonged down draft, thus providing full protection.

USE ADSCO

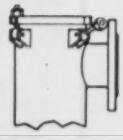


S-Type ADSCO Strainers screen out foreign matter from oil, water, and other liquid lines. Damage to valuable equipment is prevented. Usually installed on suction side but can also be used for discharge or other services.

S-TYPE

STYLE B COVER

Toggle and Bolt Type



Cover held in place by toggle bolts. This design simplifies removal of cover while cleaning basket screen. In sizes from 4" to 12", for pressures to 50 psi.

STRAINERS

AMERICAN DISTRICT STEAM COMPANY, INC.

NORTH TONAWANDA, NEW YORK

Since 1877

previously opened at St. Petersburg and Tampa, will be opened in Miami. *J. E. V. DINGEMANS* and *W. H. BARRERE* will be in charge.

For the Trumbull Electric Dept. of *GENERAL ELECTRIC CO.* — *ALFRED E. CARPLUK* has joined the sales engineering staff. He will located in the Boston office where he will do job estimating and layout and will act as engineering and sales liaison with the main offices of the firm in Plainville, Conn. Mr. Carpluk has replaced *J. J. JAMISON* who has been called to active duty with the Navy.

For *SUPERIOR VALVE & FITTINGS CO.* — *DAVID G. DODDS, JR.* has been appointed field salesman for territory in New York and New England as an assistant to *F. NEIL ROBSON*, district manager.

For *RADIATOR SPECIALTY CO.* — Four new district representatives for "Solder Seal" products. *ROBERT A. BOND* will be district representative in the Miami area; *E. G. BUNZ* in the Cincinnati area; *G. P. MEAD* in the Buffalo area and *HENRY J. OURSLER* in the Philadelphia area.

For Electro Dynamic Div., *GENERAL DYNAMICS CORP.* — A new sales engineer. *DOUGLAS S. BIRGFELD* has been appointed to the Philadelphia district office. His addition to the staff is part of an expanded

UNIT AIR CONDITIONERS

Are now available in three sizes—3, 5 and 7½ horsepower. These superior Units have extra-large refrigerating surfaces: they deliver more cooling effect per dollar, and we can prove it! Built into them are 70 years' experience.

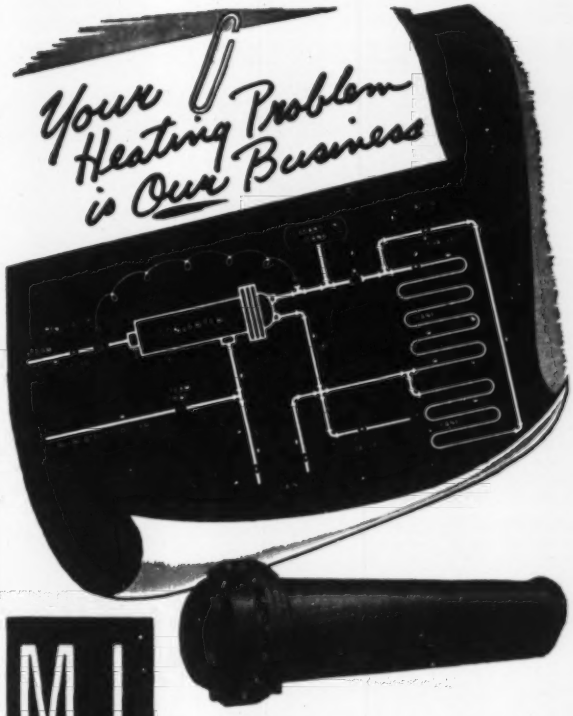
Get the full facts on Frick Units before you buy: write for Bulletin 522. If you need a still larger air conditioning system, ask for Bulletin 504. Branches and Distributors in principal cities, the world over.

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA. U.S.A.

Also Builders of Power Farming and Sawmill Machinery



M&L ...Traditionally the right equipment for every Water Heating purpose

When your plans include heating water with live or exhaust steam—when they call for hot water supply to radiant heating panels or other hot water systems—then use M & L equipment.

There are many reasons why M & L equipment is traditionally selected for dependable, uninterrupted service—one of which is the extreme care exercised in assembling, to insure longer service life.

Standardized Flexibility

The unique M & L method of fabrication, which permits custom-built equipment to be made from standardized components at a substantial saving in first cost—fits the equipment to the job to be done.

Send for more details on this worthwhile economy. Please include complete operating conditions in your inquiry to receive an accurate, individual proposal.

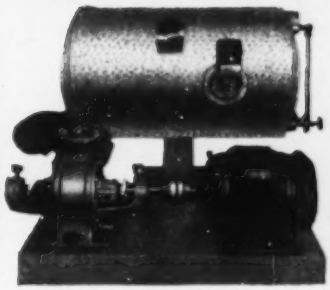
1954

Manning & Lewis Engineering Co.

32 Ogden Street Newark 4, New Jersey

SALES REPRESENTATIVES IN PRINCIPAL CITIES

For EVERY CONDENSATE RETURN JOB



APCO HORIZONTAL UNITS
(Simplex and Duplex)

are used whenever the return comes back above the boiler room floor level. Will not vapor bind or lock. Free running clearance allows for expansion due to heat. Catalogued in sizes from 2,000 to 100,000 sq. ft. E. D. R. Larger sizes available.

BULLETIN H-113

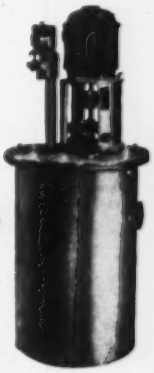
AURORA *has the* COMPLETE ANSWER

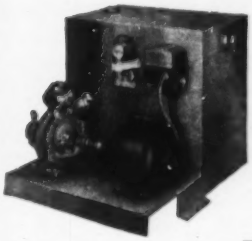
Complete satisfaction in thousands of installations is YOUR assurance that customer-pleasing Apco and Aurora Condensate Return Units will back you up with profit and good will. Write for descriptive bulletins — then install a few jobs — and BE GLAD YOU DID.

AURORA VERTICAL UNITS
(Simplex and Duplex)

for ECONOMY where returns are too low for horizontal pumps or below floor level. Quiet, smooth, lasting and efficient. Apco Turbine-Type Pumps up to 40 lbs. G. P. M.; Aurora Centrifugal Pumps for larger units. Catalogued in sizes from 2,000 to 100,000 sq. ft. E. D. R. Larger sizes available.

BULLETIN 113





APCO Packaged Square Tank Units for small, low pressure jobs (Simplex and Duplex)

— 10 to 40 lbs. — up to 15,000 rated sq. ft. E. D. R. Equipped with the utterly simple, highly efficient, remarkably trouble-free and lasting Apco Pump. Outstanding values.

BULLETIN 113-ST

PUMPS *"by Aurora"* for MANY PURPOSES

We invite you to acquaint yourself with the wide variety of Pumps "by Aurora." Among them you will find sizes and types for practically all liquids handling duties in Industry — in the Home — on the Farm.

Write for Condensed Catalog or Individual Bulletins

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA always PUMPS

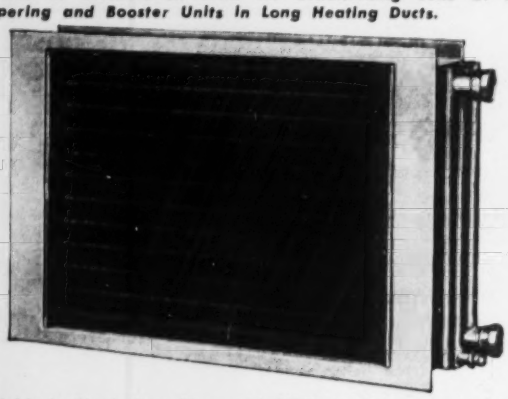
AURORA PUMP COMPANY

SUBS DIARY OF THE NEW YORK AIR BRAKE COMPANY

80 Loucks Street Aurora, Illinois

New . . . REMPE "Hi-Cap" STEAM HEATING COILS WITH DEFROSTER

For Use In Combination With Air Conditioning Coils Or As Tempering and Booster Units In Long Heating Ducts.



Available in Single Row Type with BTU per hour capacity from 60,000 to 360,000. In Double Row Type, for heavy duty service, in capacities from 129,000 to 775,000 BTU per hour. Heavy gauge steel casings. Copper tubes and headers. Tested 350 lbs. air pressure for steam working pressures up to 125 lbs. Defroster-standard equipment. Also suitable for hot water.

Write for Details

REMPE CO. — HEAT TRANSFER EQUIPMENT

REMPE COMPANY

358 N. Sacramento Blvd., Chicago 12, Ill.

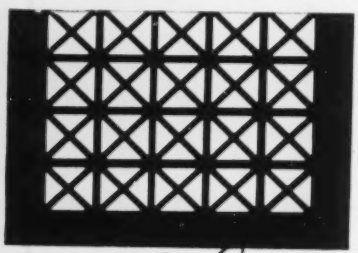
Complete facilities for fabrication of pipe coils—all types—all materials. Engineering service. Send details for price.

sales and advertising program for the company under the direction of *DEAN W. PAUL*, who is sales manager.

For *COMBUSTION CONTROL CORP.* — Two new representatives. *SNYDER CO., INC.*, 2604 Kermit Highway, Odessa, Texas, is acting sales and service representative covering southwestern Texas. This is a branch office of Snyder Co., Inc. of Tulsa, Okla. *INDUSTRIAL BOILER & EQUIPMENT CO.*, 975 Jackson Ave., Memphis, is sales and service representative covering the territory including the states of Arkansas, Mississippi and Tennessee west of the Tennessee River. *LUTHER H. HUCKABEE* and *THOMAS HOLEMAN* are officials of the Memphis firm.

For *DRYOMATIC CORP.* — Several new sales and service representatives to handle dehumidifiers in the Middle West. They are: *O. C. McNAIRN*, 1111 Brookpark Rd., Cleveland, for the Cleveland-Akron-Canton area; *ALVIN R. CLOSE*, Toledo, northwestern Ohio area; *INDIANA WEATHERMAKERS*, 625 N. East St., Indianapolis 2, covering central Indiana; and *CHARLES E. ALLEN*, 1560 Woodlawn S.E., Grand Rapids, covering the state of Michigan.

For The *MARLEY CO.* — A change of address and new manager for its Houston, sales office. The sales office has been moved from the plant to a separate office at 1601 Commerce Bldg. in downtown Houston. *ROY W. MAZE* is manager of the new office.



for *Enhancing* **beauty —**

Specify Hendrick Grilles

Add a touch of beauty and utilitarian design to your decorative motif with Hendrick Perforated Metal Grilles. Your customers will appreciate that extra elegance they add to a room.

Fabricated in sizes with positive, clean-cut perforations and with no burrs or imperfections of any kind, Hendrick Grilles are a cinch to install because they always lie flat — won't bend or warp.

Hendrick Perforated Metal Grilles provide more-than-ample open area for free passage of air flow and they're available in over one hundred attractive designs to choose from in aluminum, bronze, steel or stainless steel. Write for more details, today.

Hendrick

MANUFACTURING COMPANY

48 DUNDAFF STREET, CARBONDALE, PA.

Sales Offices in Principal Cities

Perforated Metal • Perforated Metal Screens • Wedge-Slot Screens • Architectural Grilles • Mitco Open Steel Flooring • Shur-Site Treads • Armorgrids

Hospital in Montgomery, Alabama, equipped with No. 5 Lo-BLAST Burner

FOR EVERY TYPE OF BUILDING

LO-BLAST

IS THE GAS HEATING "BUY"

From coast to coast, you'll find Lo-BLAST Power-type Conversion Gas Burners heating buildings ranging from small residences to entire villages heated from a central plant. Preference for Lo-BLAST springs from proved efficiency, safety, durability . . . *operating records show an average saving of* 10%!

Compare these operating and construction features:

Power Burner Design. Perfect combustion, regardless of draft—a proved fuel saver. Safe and efficient for down-draft units.

Simple to Install. Every Lo-BLAST is factory tested on gas and shipped assembled.

Safe Operation. Lo-BLAST comes equipped with dependable, foolproof safetys.

Soft, Quiet Flame. No "pop" when the Lo-BLAST goes on or off—burns so smoothly you can hardly tell it's running.

Easy to Service. All parts are accessible—nothing in the firebox but the fire. Simplicity of design and durable construction reduce service to a minimum.

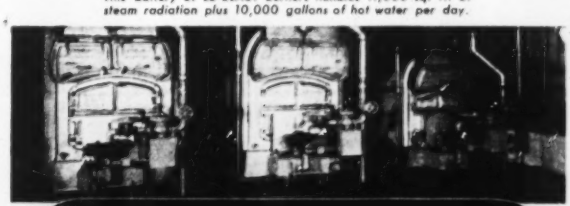
Long Lasting. Many Lo-BLAST Burners have been in operation 15 years without service.

Complete Capacity Range. Units available from 70,000 to 20,000,000 BTU input.

Lo-BLAST Economite

The "mighty-mite" of conversion gas burners—capacities from 70,000 to 500,000 BTU. All the famous design features of the larger Lo-BLAST packed into a low-cost unit for residential use. Write for descriptive literature.

This battery of Lo-BLAST Burners handles 11,000 sq. ft. of steam radiation plus 10,000 gallons of hot water per day.

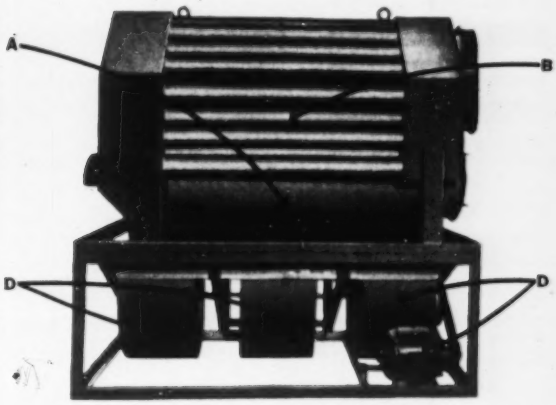


MID-CONTINENT METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

an inside story

on National Champion direct-fired Heaters!

Externally, many direct-fired space heaters look alike, but, internally, it's a different story. Here's the "Inside Story" of an efficient, rugged, dependable direct-fired heater.



internal construction . . .

a. Teardrop Stainless Steel Firebox Design

National Champion engineered to provide clean wipe and eliminate refractory maintenance—an efficiency factor.

b. Straight-In-Line Economizer Tubes

Unrestricted, straight flue gas economizer tubes allow passage of fumes to exhauster fan. Another economy factor allowing over 80% efficiency.

c. Heavy and Light Oil Series Burners

Listed by Underwriters' Laboratories, Inc. Each unit equipped with an electronic flame failure control. Burners designed for Nos. 1, 2, 4, and 5 fuels.

d. Heavy-Duty Blowers with Resilient Mounted Motor

Both motor and blowers operated on ball bearings equipped with extended oilers for easy servicing. Blower wheels dynamically and statically balanced.

e. All-Over Construction

Convector tubes, teardrop firebox and internal structure are welded into a rugged one-piece unit. Heavy angle iron frame construction and internal reinforced casing provide a sturdy unit for years of trouble-free service.

No matter what large space heating problems arise for your clients, you are assured that a National Champion installation will be an economical and wise solution!

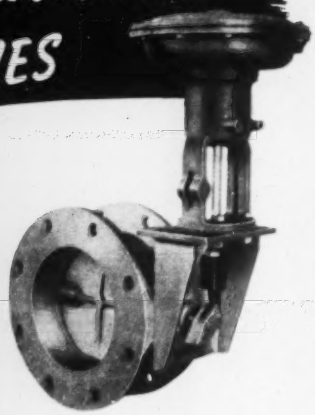
Information and specifications available upon request from National Heater Company

National Champion direct-fired Heaters, a product of

NATIONAL HEATER COMPANY, *Inc.*

2182 CLEORA AVENUE, DEPT. A, ST. PAUL 4, MINNESOTA

W.S. ROCKWELL VALVES



for

- AIR CONDITIONING
- HEATING SYSTEMS
- DUST COLLECTING
- VENTILATING SYSTEMS
- WATER PIPING
- DRAINING & FILLING

For uniform, quick control and shut-off, manually or automatically—

For minimum pressure drop when valve is fully open—

You're sure, you're safe with Rockwell butterfly or slide valves —always dependable.

Temperature—up to 2000°F. Pressure to 300 p.s.i. Construction—any metal or rubber lined. Pipe sizes to 120".

W.S. ROCKWELL COMPANY

2543 Eliot Street • Fairfield, Conn.

Butterfly Valves • Slide Valves • "Blast Gates"

For The *EMERSON ELECTRIC MFG. CO.* — The Davenport, Iowa district office has been moved to the AIC Bldg., 617 Brady St.

For *CENTURY ENGINEERING CORP.* — *EVERETT W. JOHNSON* is the new sales manager of the eastern Iowa and western Illinois districts.

For *SERVEL, INC.* — A new distributor for the air conditioning division is *TODD-FORD, LTD.* This company will handle the San Antonio, Texas area. It is managed by *JOHN W. TODD* and *JOHN G. FORD.* Offices are located at 1200 N. Colorado St., San Antonio.

For *SAWHILL MFG. CO.* — A new district sales manager for the St. Louis area is *ARTHUR G. GOUGH*, who will have offices at Suite 1122, Ambassador Bldg., Seventh and Locust Sts., St. Louis 1, Mo.

For the *McINTIRE CO.* — Two new representatives: *I. H. COHLER CO.*, Chicago, Ill., for the Illinois, Wisconsin, Minnesota, Iowa and St. Louis, Mo. areas; *MASON EMANUELS CO.*, Seattle, for the Oregon, Washington and British Columbia, Can. areas.

I. BEN KAGEY & ASSOC. is a new manufacturers' agent located in Atlanta, Ga., covering the states of Georgia, Alabama, Tennessee, South Carolina and Florida. This company will specialize in air conditioning, heating, boiler plant equipment and allied mechanical equipment calling on contractors and industrials in that territory.

IMPORTANT NOTICE
Shipping Schedules

IMMEDIATELY AVAILABLE FROM STOCK

These popular sizes of WHITLOCK STEEL SHELL STORAGE HEATERS are in stock at Hartford . . . ready for immediate shipment to serve your water heating needs. You get two big savings when you choose a stock Whitlock Heater: (1) immediate availability saves you time (2) quantity production in our plant saves you money. Select your heaters from this group . . . take advantage of these savings.

WHITLOCK STEEL SHELL STOCK
TYPE K STORAGE HEATERS

Shell Size	Shell and Head Thicknesses	Storage Capacity	* Heating Capacity
30" x 96"	1/4" x 3/8"	280 gal.	500 GPH
36" x 120"	1/4" x 3/8"	500 gal.	800 GPH
42" x 120"	3/8" x 1/2"	680 gal.	1250 GPH
48" x 120"	3/8" x 1/2"	870 gal.	1500 GPH

* 40° to 180° F. with steam at atmospheric pressure
Construction and stamping in accordance with ASME Code

Authorized Representatives in Other Principal Cities In Canada: Darling Brothers, Ltd., Montreal

At a slight additional cost, any of these Heaters can be furnished with anti-corrosion, non-metallic coatings: air-drying enamels, resins, cement. For full information and free estimates, contact your nearest Whitlock office or representative — or write us at Hartford for Bulletins 40A and 46.

THE WHITLOCK MANUFACTURING CO.

44 South St., Hartford 10, Conn.

New York • Boston • Chicago • Philadelphia • Detroit
Richmond

WHITLOCK HEATERS

That's right
LOOK AGAIN

ALL TRAPS are NOT ALIKE

here's why the
THERMOSTAT *in*
Sterlco **TRAPS**
does more for you . . .

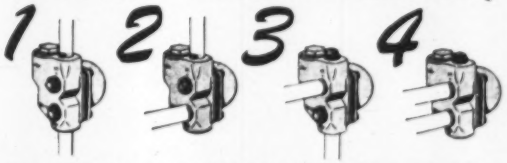
1. It compensates for changes — operates satisfactorily even if pressures vary.
2. It cannot be damaged by excessive steam pressures or by freezing.
3. If the bellows is damaged, the spring action closes the valve. Trouble is immediately located because unit or radiator becomes cold — no waste of steam — no searching. Thermal element easily replaced.

The ¾" 69B FLOAT and THERMOSTATIC TRAP

Ideal for installation and rehabilitation of unit heaters. Dependable, compact, large capacity, easy servicing and rugged construction makes 69B an outstanding performer on unit heaters and other steam heating equipment.

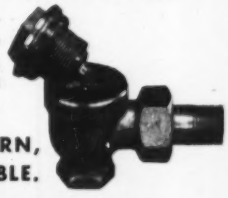
Install **the most convenient Way**

1 2 3 4



The ½" 7–50A ANGLE RADIATOR TRAP

Keep radiators clear of condensate without wasting steam. Sturdy bronze bodies and covers—replaceable seats. Angle, Straightway, Corner or Vertical styles.



STEAM HEATING is MODERN, EFFICIENT and DEPENDABLE.

STERLING, INC.

3732 N. Holton St., Milwaukee 12, Wisconsin

CONDENSATION AND VACUUM PUMPS

HEATING SPECIALTIES

TEMPERATURE CONTROLS

how

Upjohn gets "baker's dozens"

Air moisture — troublemaker in many processes — could play havoc in the processing of "Gelfoam," Upjohn's sponge-like material for the control of bleeding in surgery. Kathabar humidity conditioning helps provide Upjohn with *"baker's dozen" production* by delivering uniformly dry air to Gelfoam baking ovens — cutting drying time, saving fuel, and maintaining product quality and uniformity.

This is just one of the numerous instances in which Kathabar's direct dehumidification is cutting costs in the chemical process industries. Manufacturers of plastics, petrochemicals, pharmaceuticals, rubber, photographic film, military powders, and many other materials use Kathabar air conditioning for production, packaging and storage. Installations range up to more than one hundred thousand cfm in capacity.

Look into Kathabar humidity conditioning now as a "straight line" to "perfect weather" production every day. Write for literature Group K-53-3, on your letterhead, please.

Kathabar
HUMIDITY CONDITIONING

SURFACE COMBUSTION CORPORATION, TOLEDO, OHIO

ALSO MAKERS OF

Surface INDUSTRIAL FURNACES ***Janitrol*** AUTOMATIC SPACE HEATING

FLEXIFLO

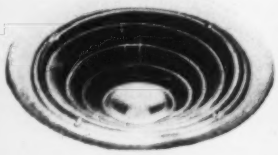
ADJUSTABLE

AIR DIFFUSERS

ADJUSTABLE AIR PATTERN | VOLUME CONTROL | DRAFTLESS DIFFUSION

FLEXIFLO
FOR COOLING

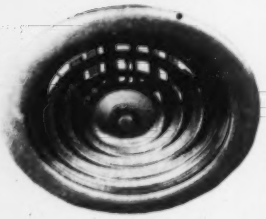
Air travels in a constant pattern parallel to the ceiling regardless of any adjustment in air volume.



Type R

FLEXIFLO
FOR COOLING AND HEATING

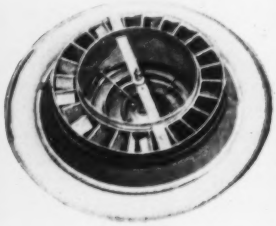
Air diffusion pattern and volume are easily adjustable, after installation, for any conditions, supplying air at any angle.



Type V

FLEXIFLO
SUPPLY AND RETURN

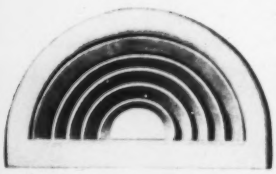
A combination supply and return outlet made with either the Type R or V blades. Fully adjustable.



Type CH

FLEXIFLO
FOR SIDEWALL AND CEILING

Provided with either Type R or V blades to blow air in desired pattern for cooling or heating.



Type S

Get the latest Flexiflo technical data on the complete line of better designed, low cost diffusers that meet any required operating conditions.

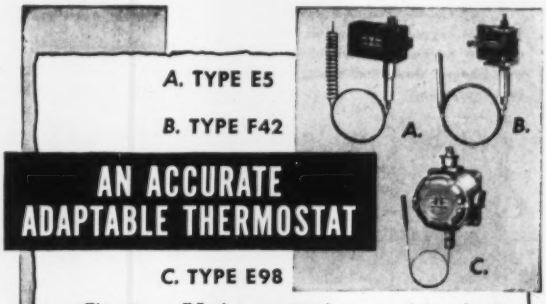
FLEXIFLO **Universal Diffuser Corp.**
1360 Garrison Ave. • New York 59, N. Y.

NEW BOOKS & REPORTS

Supplement to Pressure Piping Code

Following the publication of the 1951 edition of the Code for Pressure Piping, published by the American Society of Mechanical Engineers, the committee that had been working jointly with the ASME Boiler Code Committee and the ASA Sectional Committees B16 and B36, recommended a revised basis for establishing allowable stresses for certain materials common to the several codes and standards. In order to put these revisions in the hands of code users, it was voted to approve publication of this 1953 supplement pending a revision of the entire Code in 1954.

Titled *Supplement No. 1 to American Standard Code for Pressure Piping* (ASA B31.1-1951), it contains revisions of several tables appearing in the original Code. Those tables revised are: Table 3, Allowable *S* Values for Pipe in Power Piping Systems; Table 3a, Allowable *S* Values for Pipe in Power Piping Systems; Table 19, Pressure-Temperature Ratings for American Standard Cast and Forged 5 Per Cent Chrome-Molybdenum Alloy Steel Valves, Fittings and Flanges When Used With Other Than Ring Joints; Table 20, Pressure-Temperature Ratings for American Standard Cast and Forged 5 Per Cent Chrome-Molybdenum Alloy Steel Valves, Fittings and Flanges When Used With Ring Joints; Table 21, Allowable *S* Values Psi for Pipe in Oil Piping Systems Within Refinery Limits; Table 26, Allowable *S* Values Psi for Pipe in Oil Piping Systems-Division B; and Tables 34 and 34a.



AN ACCURATE ADAPTABLE THERMOSTAT

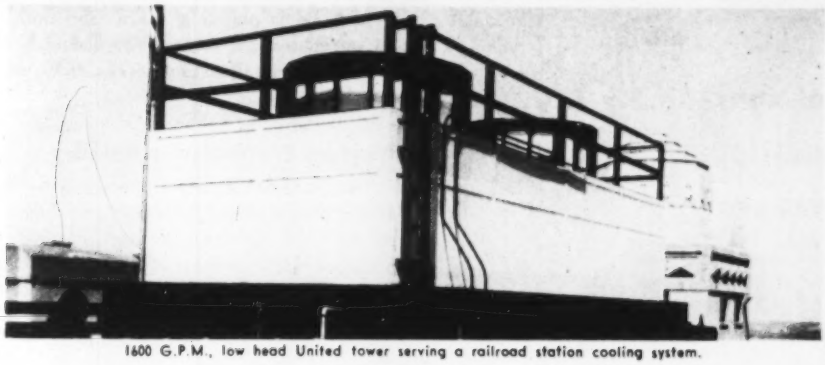
The type E5 thermostat is a precision-built temperature control which can be fitted with a wide variety of thermal assemblies and switches to suit the particular application. Temperature limits -150° F to +600° F.

The type E5 has been used on ovens, water baths, incubators, hot plate presses, cooling cabinets, air conditioning equipment, food and drink vending machines. Shown are three variations, the E5 covered by bulletin #3-2, Type F42 "skeleton" model covered by bulletin #3-3, and Type E98 in explosion-proof housing covered by bulletin #3-5. Write for information on the models of interest to you.

UNITED ELECTRIC CONTROLS COMPANY
87 School Street, Watertown, Mass.

STANDARD & SPECIAL THERMOSTATS & PRESSURE SWITCHES

Best Protection for a Good A-C Job!



1600 G.P.M., low head United tower serving a railroad station cooling system.

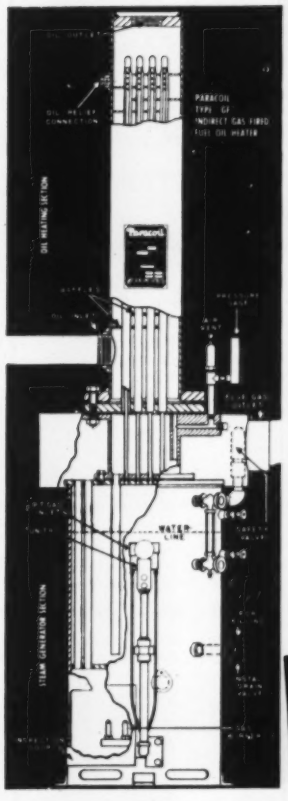
A UNITED COOLING TOWER

It takes a good cooling tower, properly designed, enginered and constructed, to make a good air conditioning job stand up. United builds that kind of tower . . . in capacities for any size installation.

Also redwood filled mechanical draft steel towers, 3 to 15 tons capacity and package type redwood spray towers, 3 to 30 tons.

Let United figure with you on your next A-C job.

UNITED COOLING TOWER COMPANY
4022 Broadway, Kansas City 2, Mo. Plant: Pilot Point, Texas
Authorized representatives in Principal Cities



WHY BURN EXPENSIVE LIGHT FUEL OILS . . . . . THERE'S A WAY OUT WITH OUR

Paracoil TYPE "GF"

INDIRECT GAS FIRED FUEL OIL HEATER

A RADICALLY NEW APPROACH TO THE PROBLEM OF ADEQUATE OIL PREHEATING UNDER ALL OPERATING CONDITIONS!

The Type "GF" Oil Heater is an integrated self-contained steam vapor generating exchanger using gas as its primary heat source.

However, the gas flame does not come in contact with the tubes containing the fuel oil. Instead, vapor from the lower steam generating section does the actual oil heating!

APPLICABLE TO ALL TYPES OF OIL FIRED APPARATUS!

As it is not dependent upon the unit it is servicing for the means of heating the oil, the Type "GF" Heater can be applied to any oil fired apparatus, be it a steam or hot water boiler, a process oven, a dryer or a kiln!

A COMPLETE SOLUTION TO THE OIL-IN-BOILER PROBLEM!

As the Type "GF" Heater is in no way connected to the steam or water space of any boiler it may be serving, there can be no possible contamination of the boiler heating surfaces in the event of an oil leak in the heater.

CHECK THESE FEATURES!

Completely factory assembled • Easy to install anywhere, even outdoors • Requires only minimum of floor space • Economical to operate • Wide range of oil heating capacities • Burns any specified type of gas fuel • High oil temperatures at all times • Operation unaffected by normal variation in viscosities of oils being heated • Reduces oil consumption through improved fuel combustion.

THE PERFECT HEATER FOR:

- Low temperature forced hot water heating systems on No. 6 oil.
- Plants with starting difficulties after week end shutdowns.
- Supplementing inadequacies in present oil preheating systems.

Approved by Board of Standards and Appeals, City of New York—Cal. No. 362-51SA

BULLETIN 60-L
WRITE FOR YOUR COPY TODAY!

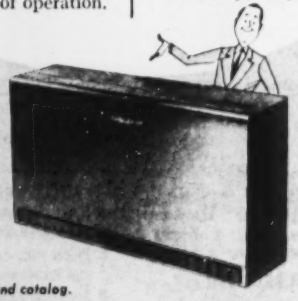
DAVIS ENGINEERING CORPORATION

Quiet beyond belief!

The Spotaire HRC Series individual room unit air conditioner that heats and cools is engineered for concealed installation and designed to function efficiently without noise...so quiet that it's beyond belief. Just check all the advantages offered by the Spotaire Air Conditioner.

The Spotaire VRC Series (also illustrated) surpasses all other floor mounted individual room air conditioners in appearance and quietness of operation.

- Heats or cools, ventilates, filters and dehumidifies.
- Individual room control for convenience, comfort and economy.
- Lower operating and installation costs over other systems. Also eliminates costly duckwork.
- For residential or commercial applications.
- No floor space required.



Long established in commercial refrigeration and air conditioning, Drayer-Hanson offers a complete line of air conditioning and commercial refrigeration products.

Write for details and catalog.

Limited number of territories available for qualified manufacturer's representatives

drayer-hanson
INCORPORATED

3301 MEDFORD STREET, LOS ANGELES 63, CALIFORNIA

Allowable *S* Values for Pipe in District Heating Piping System.

Supplement No. 1 is priced at $1.00 a copy. The complete Code is priced at $3.50 and both publications may be purchased for $4.00. Publisher is the American Society of Mechanical Engineers, 29 W. 39th St., New York 18.

Accident Prevention in Industry

The National Safety Council's new *Handbook of Accident Prevention for Business and Industry* shows how to set up and maintain a safety program in industry or business establishments. Detailed information is included on subjects such as plant layouts, materials handling, housekeeping, machine guarding, electrical hazards, pressure vessel hazards, first aid, fire prevention and personal protective equipment.

The handbook advises the small business man, who cannot afford to employ a full time safety specialist, how to make use of outside assistance. Service and insurance organizations, governmental agencies, trade associations and professional societies which can help the small operator are described.

Further information and prices are available from the National Safety Council, 425 N. Michigan Ave., Chicago 11.

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Inert-Gas-Shielded Metal-Arc Welding Process covers a series of educational lectures on this process which was

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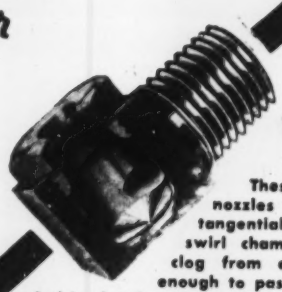

These are "non-clogging" nozzles with a single large tangential lead hole to the swirl chamber that will never clog from any impurities small enough to pass through the orifice. Swirl chamber is conical on both ends and pivots liquid like a top to produce an exceptionally fine, evenly distributed, balanced spray of about 80° included angle. Wider spray angles up to 130° can be furnished to order.

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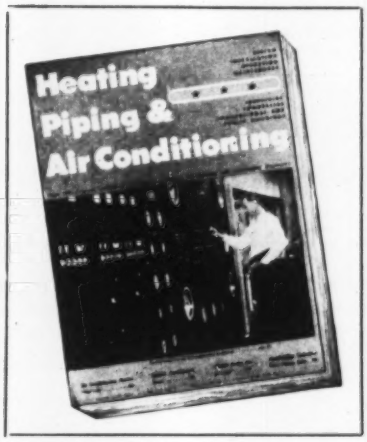

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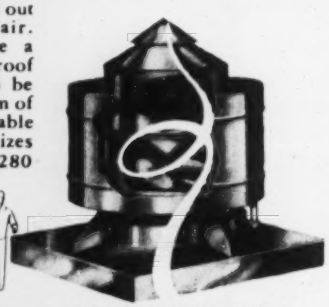

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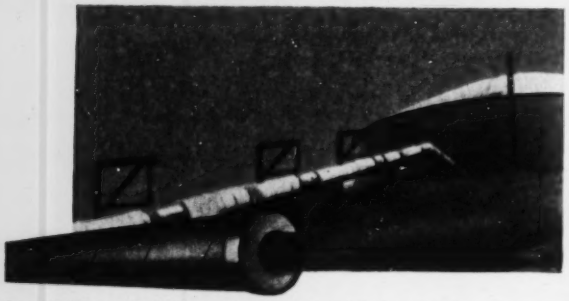

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delivered at the annual meeting of the American Welding Society. The lectures were presented by W. H. Wooding, Superintendent, Metals Section, Philadelphia Naval Shipyard.

There is a brief introduction to arc welding and the developments since World War I concerning the protection of the arc and molten metal from atmospheric contamination. Emphasis is given to welding in inert-gas atmospheres.

Mr. Wooding uses sketches and photographs to portray the development of the process, the equipment required, the necessary controls and their functions. Special sections are devoted to the operation of the equipment from the operator's viewpoint as well as that of the supervisor and the engineer. The safety precautions necessary for protection of the operator are also included.

The characteristics of the inert-gas-shielded metal-arc and the mode of metal transfer are illustrated and explained. The effect of variables on the operation of the equipment in all positions of welding is demonstrated. One section is devoted to the application of the process in fabricating complex structures.

The 30-page pamphlet, priced at $1.00, may be obtained from the American Welding Society, 33 W. 39th St., New York 18.

Welding Aluminum

A new and enlarged edition of the process manual, *Welding Aluminum*, has recently been published by the Reynolds Metals Co. The new edition contains material on 34 processes suitable for welding, brazing and soldering aluminum and its alloys. These processes are shown

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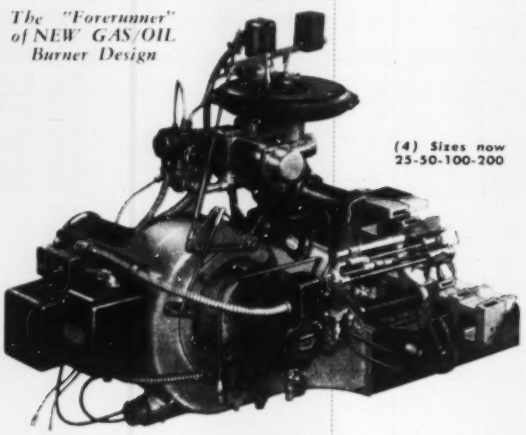

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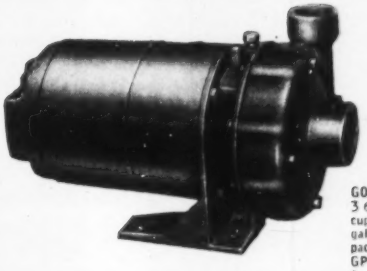

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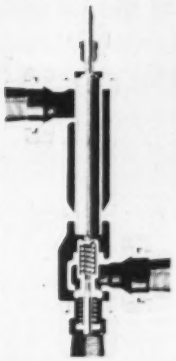

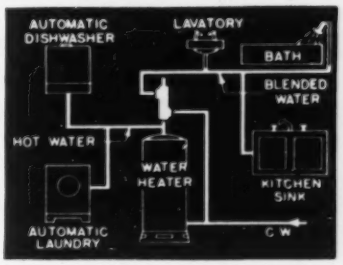

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in a chart giving their relation to one another and indicating those processes most widely used.

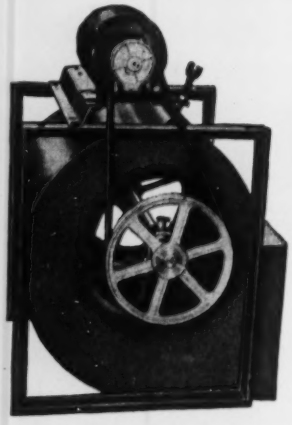
A second chart breaks down the wrought aluminum alloys and shows the various joining methods suitable for the various alloys. A third chart covers the aluminum casting alloys. Detailed weldability ratings for the wrought alloys and casting alloys are presented in tables rating them for gas, arc, and resistance welding processes as well as for brazing and soldering. Flow, stud and induction welding and other comparatively new processes are described in the manual.

The 136-page, pocket-size manual is ring-bound and contains 35 tables and more than 125 charts and illustrations. It was prepared by Charles Bruno, Reynolds chief welding engineer, and G. W. Birdsall, director of editorial services.

The manual will be sent without charge to any engineer, designer, technical man or company executive requesting it on company letterhead. To others, the price is $1.00 a copy. Requests should be sent to Desk PR, Reynolds Metals Co., 2500 S. Third St., Louisville 1, Ky.

Industrial Hygiene Transactions

Transactions Bulletin No. 23 contains several manuscripts and summaries of discussions presented at the Chemical-Toxicological and Engineering Conferences held at the 17th annual meeting of the Industrial Hygiene Foundation in 1952. Included are a summary of the discussion on "Significance of Exposures to Dusts of Low Silica Content," and a paper on "Designing Exhaust for Control of Beryllium Fumes, Dusts and Mists," by C. W. Schwenzfeier, Jr., vice president, Brush Beryllium Co.



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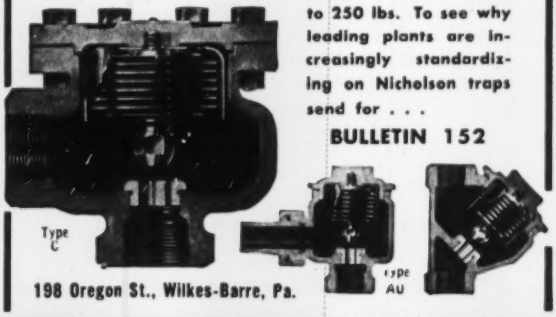

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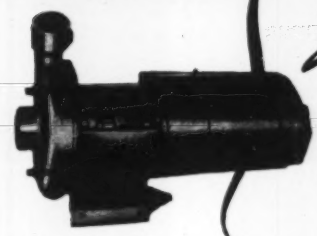

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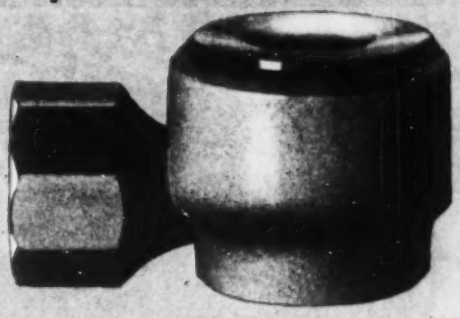

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OTHER BOOKS AND REPORTS

AUTOMATIC CONTROL OF HEATING AND AIR CONDITIONING — a comprehensive study of how automatic controls and heating and air conditioning equipment work together. Written by John E. Haines, vice president of Minneapolis-Honeywell Regulator Co., it introduces basic principles, illustrates these principles by giving the construction and characteristics of representative control devices and shows how to combine individual control devices into control systems for heating and air conditioning.

Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, the 354-page book is available at $6.75 a copy.

This book will be reviewed in more detail at a later date.

SYMPOSIUM ON FATIGUE WITH EMPHASIS ON STATISTICAL APPROACH—II — a compilation of papers on the variations and measurements in determining the physical properties of materials. These papers were presented at the Symposium during the 50th anniversary meeting of the American Society for Testing Materials in New York in 1952 and represent a continuation of the subject of statistical aspects of fatigue. Copies of this 96-page symposium can be obtained from the headquarters of ASTM, 1916 Race St., Philadelphia 3, at $2.00 each.

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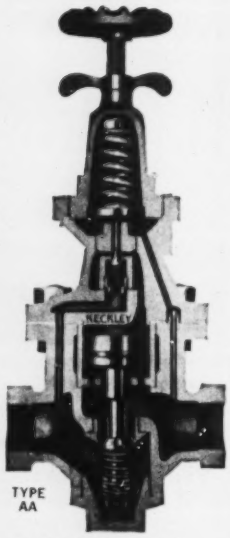

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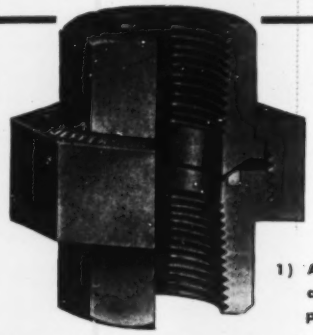

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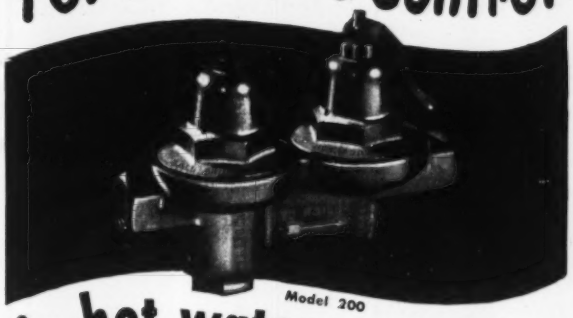

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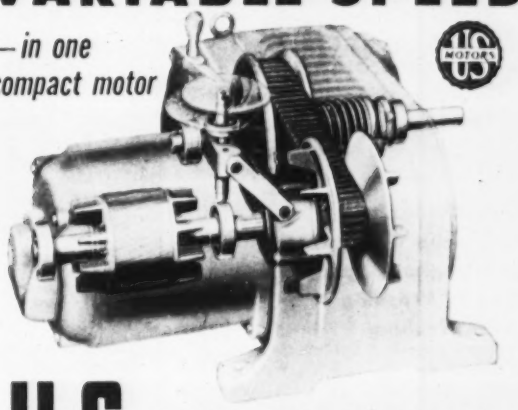

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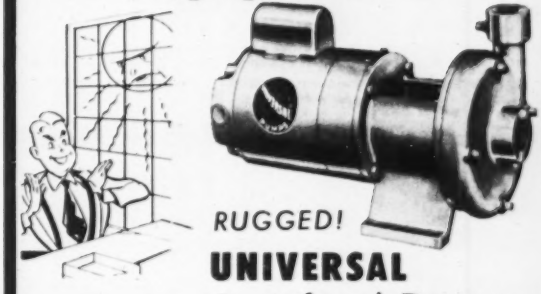

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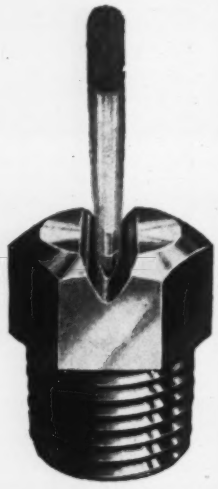

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INTERNATIONAL CHURCHMANS EXPOSITION, 19 S. LaSalle St., Chicago 3 — Second annual exposition, October 6-9, Chicago Coliseum. Hall of Church Designs and International Church Buildings Forum will be featured.

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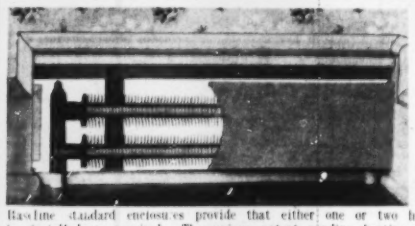

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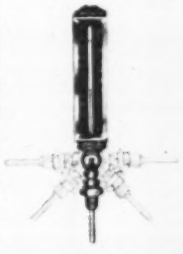

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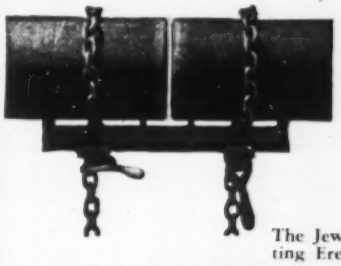

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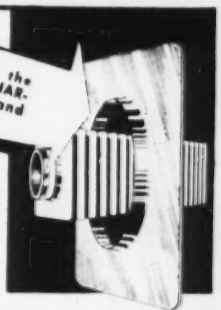

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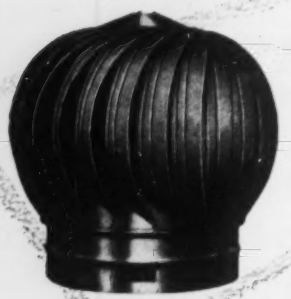

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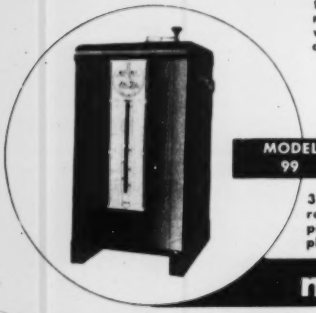

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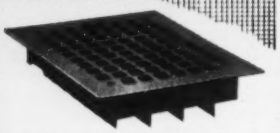

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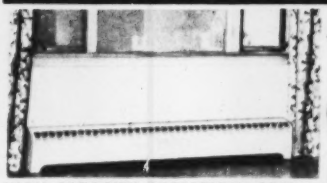

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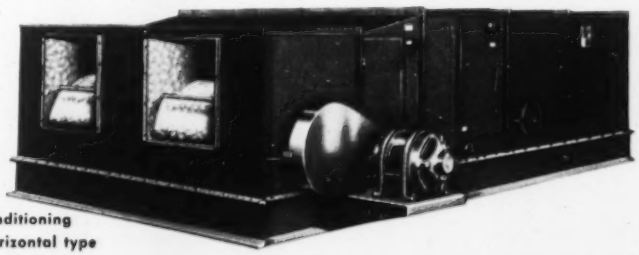

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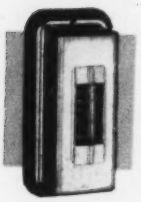

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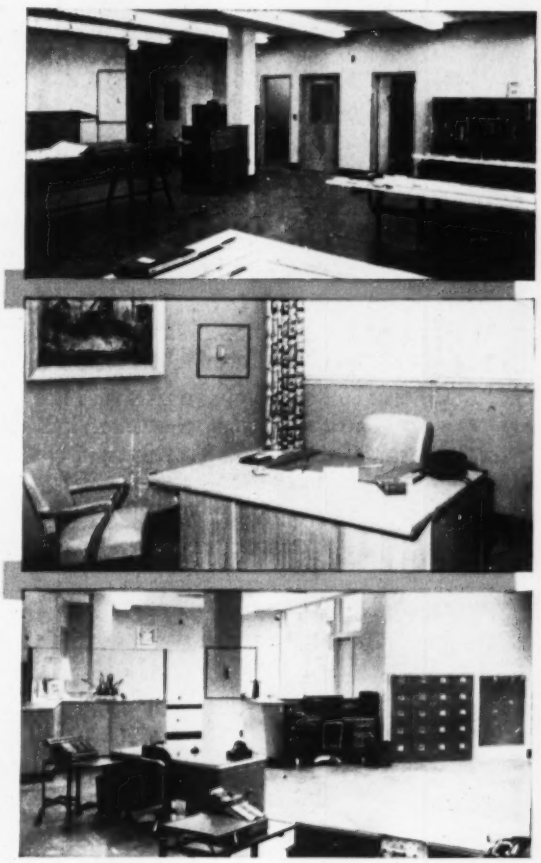

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T-900 Master
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